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FIGURES OF EXPORT TRADE.

The issuance of the detailed figures of foreign trade for December completes the data for the fiscal year 1908. Our readers are already aware that while the trade balance was more than ever in favor of the United States, there was a serious decline in the grand total. The gross imports were $1,116,440,081; the gross exports were $1,752,833,247. This is a good deal of international commerce, but both items are far below those of 1907. The decline is but symptomatic of the world-wide dullness and depression that now has lasted well-nigh two years, but has been most felt during the past twelve months. We have already noted the falling off in electrical exports; and in this respect December did nothing to redeem the situation. The export of electrical instruments amounted to $611,616 as compared with $515,701 for the same month in 1907; and the export of heavy electrical machinery for the corresponding periods declined from $837,811 to $587,559. Thus the slight gain on instruments was more than offset.

The totals for the year have no element of cheerfulness about them, although it is believed that the conditions prevalent in 1908 are being left behind. The total export for 1908 of electrical instruments and appliances was $5,657,008, a falling off of not less than $2,068,537 from 1907. The total export of heavy electrical machinery was $6,956,722 as compared with $9,735,230, a falling off to the tune of $2,778,508. The two items together show $12,613,730 as compared with $17,460,775, or a net falling off of $4,847,045. This is a loss of over 25 per cent in the one year. The shrinkage has been both in bulk and in value, and electrical exporters have their work cut out to get back to the former high levels. We believe it can and will be done; but that will require courage and persistence and thoroughly scientific methods of finding out what the markets need and of filling those specific wants.

NEXT MEETING OF THE INTERNATIONAL ELECTROTECHNICAL COMMISSION.

The International Electrotechnical Commission held a council meeting in London last October, as was duly announced in our columns about that time. The German delegates intimated at the meeting the hope that if the next full meeting of the commission were scheduled for 1910 Berlin might be selected as the place of meeting. We learn that, since the adjournment of the council meeting, a formal invitation has been extended by the German national committee to the secretary of the commission in London, asking that Berlin may be made the meeting-place of the next convention, and that this invitation has been regularly accepted, although the date of the convention has not yet been assigned. The International Electrotechnical Commission was suggested at the St. Louis congress, nearly five years ago, and it was organized three years ago. Up to the present time it has accomplished nothing but "preliminary work." Of course, much has to be done in order to organize and effect the pre-

liminary arrangements for so scattered a body as an international electrotechnical commission, so that a reasonable time must be allowed for inauguration and initiation. But it is now time to expect real accomplishment. There is much to be done. The rules under which dynamo-electric machinery and apparatus are standardized and rated vary materially in different countries. By a little adjustment and compromise it should be possible to arrive at a single set of international rules, commencing with a minimum number and gradually extending them as far as may be found desirable. It is not to be expected that all of the rules affecting the standardization of all machines should at once be made international. It is, however, reasonable to expect that, commencing, say, with direct-current stationary machines, the rating in kilowatts of a given machine should be the same in all countries. It is irrational and incongruous that a machine should be rated at 25 kw under the rules of one country and at 35 kw under the rules of another country. In addition to machine rating there is before the commission the important question of international symbols and notations. At present there is a wide divergence in standard electrical engineering text-books in the matter of symbology. A great simplification would be introduced if this were rendered internationally uniform. This unification cannot be brought about suddenly throughout. It should be possible, however, to commence with a few of the most important and frequently used symbols and gradually to extend the international list. It is much to be hoped that the American Institute of Electrical Engineers will endeavor to become a factor in the situation thus presented, thereby resuming the prominence which its initiatory work gave it at the Chicago, Paris (1900) and St. Louis international electrical congresses.

The Graphical Clock Diagram.

The clock diagram of simple alternating e.m.fs. and currents is a graphic device that has been used with advantage ever since alternating-current technology began. A clock-hand, rotating uniformly over the face of a clock, makes one revolution to the cycle of the alternation considered. The length of the hand is made equal to the maximum cyclic magnitude of the alternating e.m.f. or current considered. The motion starts from the 6 o'clock position of the clock hand in a counterclockwise direction, and the projection of the rotating arm on a horizontal plane through the axis, the 9 o'clock and 3 o'clock points, gives at each instant the magnitude of the sinusoidally alternating quantity, which is proportional to the sine of the angle moved over by the rotating arm from the starting moment. If we consider the time angle as a positive angle in the trigonometrical sense, the rotation of the hand must, by convention, be opposite to that of the regular clock movement; that is, it must be counterclockwise. Some writers, however, express the motion of the arm as clockwise, which forces the angle described to become negative trigonometrically. In order to maintain uniformity in mathematical convention, it is desirable that all writers should rotate their clock-arms in the same direction, and the preferable direction is in conformity with established trigonometrical positive angular motion, or is counterclockwise.

If we place two hands on our clock-face diagram, one for the alternating e.m.f. in a circuit, the other for the alternating current, and make both hands travel counterclockwise at the same angular velocity, we can represent the relative phase of the current and e.m.f. by the fixed angle set between the two rotating arms. In any single circuit, this angular displacement cannot exceed 90 deg., and in practice is never quite 90 deg. Each rotating arm then develops its own horizontal projection, or sinusoidal motion, in the manner familiar to all who have studied such diagrams. The locus of the motion of each rotating arm extremity is clearly a circle, and the effective value of any such simply alternating quantity is well known to be its maximum value divided by 52. It is well known that the electric power developed in a simple alternating-current circuit is represented at any instant by the product of the instantaneous e.m.f. and the instantaneous current; that is, by the product of the two instantaneous clock-diagram projections. This product has been recognized as dissymmetrical with respect to zero power, but as equivalent to the joint action of a steady power and an alternating power. The steady power is the product of the effective e.m.f. and current into the cosine of their phase difference, and is the power recognized by the engineer as expended in the circuit. The accompanying alternating power is the product of the effective e.m.f. and current, acting at double frequency. Since engineers rarely take into account this alternating component of power, which, in the long run, carries no energy into or out of the circuit, no attempt seems to have been made to represent it on the clock diagram, especially as it involves a speed of rotation twice as great as that of the e.m.f. and current hands.

There can be no doubt, however, that it is desirable to include the alternating power in the clock diagram, as it conveys the essential physical facts to the mind of the engineer in a very simple and comprehensive graphic manner. This has been shown very neatly by Mr. J. Irving Brewer, in an article in our issue of Jan. 21. Taking the e.m.f. vector as of standard phase, he marks off the current vector in its proper phase relation thereto, and then extends the current vector to a distance representing the product of the two rotating vector lengths—that is, the product of maximum e.m.f. and maximum current. On this produced length as diameter he describes a circle. The projection of the center of this circle is, on the power scale adopted, the steady average power expended in the circuit. The uniformly rotating clock hands of e.m.f. and current are then geared up with the rotating power hand in a doubled angular-velocity ratio about the said center, so that as the e.m.f. and current hands rotate once, the power hand will rotate twice. The projection of the power hand on the plane of reference then gives the instantaneous power in the system. Mr. Brewer makes his hands all rotate negatively, or clockwise, but the diagram becomes conventionalized by looking at it in a mirror.

Expert Testimony.

The New York State Bar Association seems to be greatly troubled over the morals of expert witnesses, particularly those of the medical variety. It seems that the slimy touch of commercialism has too often besmirched the snow-white coat of Pure Science and that something drastic should be done about it at once. The Bar Association has, in fact, adopted a committee report looking to purification. It suggests that the Appellate Court appoint a board of consultants, any of whom may be called to testify by litigants or the court, and to keep

the board unsullied by the machinations of Mammon, its members should receive witness fees only, save as otherwise ordered by the court. Now, all thoughtful citizens fully realize that something should be done to place expert testimony, medical or other, upon a sounder and more dignified basis than at present. Every celebrated case, civil or criminal, involving technical issues emphasizes the need of reform in several particulars, not the least of which is compelling decently courteous treatment of the witness by the attorneys in the case. No insinuations are too evil or baseless to be heaped upon reputable men of science whose testimony is distasteful to pettifogging counsel, and under present conditions few judges have the courage to call a halt.

We quite agree that there is need for reform, but the lawyers have the remedy in their own hands all the time if they have the disposition to apply it. If a shady physician gives dubious evidence in a tort case, for instance, who is it that procures his services unless it be the shady "ambulance-chaser" who is working up the case on a contingent fee? If a technical expert wanders from the plain truth to an extent that would convict a fact witness of perjury, in nine cases out of ten the attorney is morally a suborner of perjury. If an expert witness for one litigant honestly differs in opinion from the other litigant's expert, as he sometimes may, it seems to be the fashion to set him down as a rascal merely on general principles, while the attorneys, unfettered by the sanctity of an oath, are under no restraint, and sometimes abuse the privilege. It is really amusing to see the lawyer weeping crocodile tears over the wickedness of the expert procured by his opponent. Let him first look after the cleanliness of his own house, and scourge out from it the rascals who try to support bad cases by worse evidence. Honesty at the bar leaves little room for dishonesty on the part of the expert. For every crooked expert there is at least one crooked lawyer who knowingly gives him employment. That there are "commercialized" experts unhappily admits of no doubt, but the way to eliminate them is for lawyers not to retain them.

As to external measures of reform, unquestionably something can be, and ought to be, done. The suggestion of an officially appointed board to be called by the court has many times been made in one form or another and in principle it is good. But it has been often, and often will be, vehemently opposed by lawyers who wish the privilege of retaining such experts as will best serve their purposes. This very opposition should give it a certain amount of prestige. But there are real objections as well, chief among which is that the highest class of men would, for the most part, decline to serve on account of pressure of private practice and the probable inadequacy of compensation. Few professional men of the knowledge and character required would care to mix up in frequent court cases at any price unless there were a radical reform of present precedure, and hence the tendency would be to gather a rather ill-assorted group of probably capable, but distinctly second-rate, men. In a medical board, every so-called "school" would insist upon representation, from the "regular" to the Indian herb doctor, and in general science the same catholicity would be in evidence. The position of an official expert to be paid at a nominal figure and blackguarded in cross-examination by both sides is not one for a self-respecting person to desire.

If one analyzes the failings of expert testimony under present conditions, they fall rather definitely into the three following classes: First, deliberate misstatements, comparatively rare, and to be cataloged under any "shorter and uglier" terms one may fancy. Second, errors of judgment, commonly with respect to matters about which there may be legitimate differences of opinion. Many cases popularly ascribed to ignorance or venality really belong in this class. In patent cases, for instance, expert witnesses fall naturally into two categories, rigid constructionists and loose constructionists. The former are from temperament disposed to set a high standard for "invention," and therefore hold a patent tight down to its claims of indubitable novelty; the latter take a very liberal view of invention and regard as from this viewpoint novel almost anything that is a little different from things absolutely familiar. Clash of opinion between the two is just as innocent and to be expected as difference of judgments as to politics. In the same way, certain United States judges are known as patent sustainers and others as patent breakers, without the slightest reflection on their integrity, the reputation being merely the reflection of their individual mental attitudes. Third, comes the most frequent and offensive cause of discordant expert evidence in accurately truthful replies to questions framed with intent to deceive. This is exceedingly common in jury cases and wherever the expert testimony can be introduced only through the hypothetical question. A conscientious expert, being under oath, must answer the question as asked directly and truthfully. The untechnical mind assumes that the question fairly represents the real issue, whereas it very often is in terms that compel an answer quite at variance with the facts as they appear in the evidence which the expert is not at liberty to consider. Then in cross-examination another squinting question may necessarily bring out a different opinion, and the expert gets the credit of perverting the truth. Some lawyers are exceedingly acute at this sort of thing, and the expert has no available means of protecting himself against it. If the court would take a hand in clearing matters up it might accomplish much good, but under present practice it rarely does.

What is really required in the interests of justice is some method of getting from men of the highest professional standing deliberate, unbiased judgments as to the technical points involved in any cause at issue. The big and broad representatives of the law feel this need and realize the shortcomings of the present loose methods which often pervert justice. Why would it not be practicable to treat technical matters as a proper subject for referees? In other words, when technical issues are involved, let the court appoint, say, three experts of known standing to pass deliberate judgment on these issues in the form of a written opinion for the guidance of the court and jury, after hearing the evidence and, if necessary, argument by counsel. The issues could be put in the form of definite questions to be settled on their merits, and the proceedings would follow the ordinary course of cases before a referee. Now and then something closely akin to this is actually done, and the statutes of some States provide means by which suitable causes can be actually tried before referees selected for their technical knowledge and acting with practically the full authority of a court. In short, a solution of the problem presented is to abolish the expert witness by establishing the expert board of referees with sufficient authority to command respect for its findings.

Consolidation of Electric Plants in Massachusetts.

The Edison Electric Illuminating Company of Boston has completed negotiations for the purchase of the electric plants of the Boston Consolidated Gas Company, the Waltham Gas Light Company, the Newton & Watertown Gas Light Company and the Chelsea Gas Light Company. An application will shortly be made to the Massachusetts Gas and Electric Light Commission for approval of the purchase of these properties, and the price to be paid will be contingent upon the action of the commission.

The electrical service of the Boston Consolidated Gas Company includes the suburban communities of Brookline and Brighton. It is planned to make a 10-year contract with the various electric railway lines operating in the Newton and Waltham district for energy supply from the Edison service. The Edison company can produce a kw-hour of energy more efficiently than any of the companies which will probably be taken over, with a reasonable allowance for distribution expenses, particularly in the cases of Chelsea and the Boston Consolidated Gas Company. The Newton company has for some time been affiliated with the Edison interests, and for the past two or three years all the electricity for street, residential and commercial service in the Newtons has been distributed by the Newton & Watertown Gas Light Company from a substation supplied with energy from the Edison station at South Boston. The Waltham Gas Light Company recently built a modern steam turbine plant in the central portion of Waltham, which operates on a combination railway, lighting and motor load. An older station of poorer economy is also in commission in Newtonville. The railway load, however, is in a measure incidental to its service, and the direct-current rating of the plant is comparatively small.

An interesting feature of the anticipated consolidation with the Edison company from the engineering point of view will be the methods adopted for supplying the Newton system of trolley roads connecting with the Boston elevated system at the western terminus of the latter. The influence of the railway load, if assumed by the Edison system, is liable to be in the direction of improved load factor, and the saving in expense through the consolidation will clearly be considerable.

The purchase by the Edison company of these properties involves about $2,000,000, which will later be paid for by an increased issue of Edison stock after the purchase has been approved and the stock authorized by the Massachusetts Gas & Electric Light Commission.

In the fiscal year ending June 30, 1908, the total net earnings from the operation of these electric plants were $221,000, or 11 per cent of the anticipated purchase price. The net earnings of the electrical department of the Boston Consolidated Gas Company were the largest of any of the plants purchased, $138,349.

The following table gives the valuation of the electric plants, lines and equipment of the Waltham, Newton & Watertown, Chelsea and Consolidated gas companies for the year ending June 30 last:

	Valuation.	Income.	Expenses.
Waltham	$440,602	$112,800	$78,092
Newton and Watertown	409,655	146,315	130,940
Chelsea	245,820	84,218	51,550
Boston Consolidated	892,711	255,769	117,420

Edison Companies Oppose Commission's Order.

The Edison Companies of New York, including the New York Edison Company and the United Electric Light & Power Company of Manhattan, the Edison Electric Illuminating Company of Brooklyn and the Westchester Lighting Company of the Bronx, appeared before the Public Service Commission of the First District of New York on Feb. 5 and asked for a rehearing on the general order promulgated by the commission in December regulating and prescribing the terms of all electrical energy contracts. Representatives of the four companies named stated their position to the commission and filed briefs setting forth their reasons for objecting to the order and asking for a reopening of the hearings. It is understood that the commission will decline to grant the rehearing and that the present action of the companies in making the demand is simply preliminary to carrying the matter into the courts. The New York & Queens Electric Light & Power Company, which had accepted the order of the commission, asked to have its protest joined with the others. He was assured by the chairman of the commission that if any modification of the order was made it would apply to all companies alike whether they had accepted the previous ruling or not. The commission has not yet given a decision as to whether or not it will grant a rehearing. After the briefs had been filed the New York Edison Company issued a statement outlining its position in the matter. In this it was pointed out that an important part of the company's business was concerned with large buildings for which contracts to supply energy by the wholesale or in bulk had to be provided. These contracts were largely the result of personal canvass and negotiation and if the company was not able to modify the phrasing or minor details of such contracts to suit peculiar conditions, its business would be seriously interfered with. The company stated that it does not seek to make special terms or give unusual privileges to any particular customer, but simply to be permitted to modify a contract to suit the particular conditions. It desires to extend to any customer every convenience or facility which the special conditions surrounding the service make practicable, provides that such features in the contract do not modify the cost to the consumer and provided that the company is prepared to extend the same privileges to all others who present the same conditions. The company expresses itself as quite willing to accept and obey the order insofar as it prohibits any variation in charge, preference in rates, refunds or special privileges, but it believes that special riders should be permitted to meet special conditions which do not affect the price and which do not mean in any way a discrimination in favor of one customer as against another. The demand for the rehearing is to secure more elasticity in the contract through provision for such riders and not to throw the door open to discriminations.

Wisconsin Commission Seeks Information Regarding Storm Losses.

The Railroad Commission of Wisconsin has sent a letter to public utility companies under its jurisdiction asking for information regarding the damage caused by the storm of Jan. 27 to 29. The object of the inquiry is to gather all available facts regarding these damages with a view to throw some light upon the allowance to be made for such emergencies under the provisions of the public utilities law.

The letter to telephone companies asks for figures of the total number of subscribers, both city and rural, and of the number of each class having interruptions. The companies are also asked to state the number of poles broken and the length of lines "down"; what other damage, if any, was received; the cost of repairs, divided between labor and material; allowances to regular subscribers for interruption; and losses on toll or long-distance business.

The law of Wisconsin provides that the Railroad Commission of that State "shall ascertain and determine what are the proper and adequate rates of depreciation of the several classes of property of each public utility." The rates of depreciation must be such "as will provide the amounts required over and above the expense of maintenance, to keep such property in a state of efficiency corresponding to the progress of the industry." Since the purpose of the rates for depreciation is, in its ultimate end, to make it possible to maintain the plant in a proper condition of efficiency from revenues, it follows that the

revenues must be sufficient in amount to enable the utility to provide for such depreciation.

Determination of what the rates of depreciation should be is a vital feature of the work imposed on the commission by the law, and, while it is a perplexing and serious problem, it is one which the commission has no right to ignore. Into the calculation of the permissive or prescribed rates of depreciation all elements which produce destruction of the value of the plant should enter.

The effects of the storm of Jan. 27 to Jan. 29 were felt more seriously by the telephone companies than by the other utilities under the jurisdiction of the commission. Both the losses due to damage which must be repaired if the utilities are to continue their usefulness and the losses resulting from interruption of traffic are the direct and tangible results of a storm against which no feasible protection would have availed the companies. The letter of the commission on this subject recognizes that heavy losses were sustained by many companies and indicates that the commission will gather all available data on the subject. This action will result in a compilation of statistics that will be of great value as showing the cost of one storm of the character mentioned. The information that will be obtained by this inquiry will not, of course, furnish conclusive figures as to the extent of the allowance which may properly be made for losses of this nature; but the compilation of data relating to these losses during a period of years, which is probably foreshadowed by the initial step of the Wisconsin commission in this direction, will help to show what reasonable provision should be made for such happenings in a system of accounting designed to be correct in principle.

Cutting Over New Trunking Telephone Switchboard in Boston.

The New England Telephone & Telegraph Company cut over a new common battery switchboard for trunking service at its Fort Hill exchange in Boston on Saturday evening, Jan. 30. The board represents the Western Electric Company's latest design, with the features of automatic ringing, automatic registering of calls, ancillary answering jacks, and is designed for a traffic in which about 95 per cent of the originating calls are trunks. The board is divided into the usual A and B portions, but the A board trunks every call originating within Fort Hill to the Fort Hill B board, thus saving a large quantity of multiple wiring and enabling the service to be handled more conveniently. The Fort Hill exchange is located in the same building as the Boston Main exchange, but it is separately equipped and operated, although serving the same business district.

The cut-over was one of the most successful in the history of the company, and the preparations for the change were made with special care to avoid any conditions that might give rise to complaints. About a month before the change from the old Fort Hill board occurred taps were made into all Fort Hill lines and trunks incoming and outgoing, and the connection to the new board broken by the usual toothpick installation close to the cut-off relays of the subscribers' lines. All lines were then tested from the office and found in proper shape. The toll trunks were brought in part into Fort Hill during the evening of the cut-over, about 40 men being engaged on the work as a whole. The toothpicks were then pulled, throwing the old and new boards upon the lines together. All lines were then verified by calling in from the cable head, the company's men flashing three times to differentiate these calls from the subscribers' calls. This duplicate check was effected on all lines without finding errors of connection, all relay contacts were found to be working properly, the outgoing trunks were then verified and the operators were transferred to the new board with resulting disconnection of the old board.

The new board has a present capacity of 5300 lines and an ultimate capacity of 9600 lines. The automatic ringing lasts 2 seconds at 4-second intervals. Automatic registration of calls is also provided in this board. The ancillary answering jacks provide practically six operators per line, by doubling the incoming line signals in the switchboard. The A board has 48 positions, of which 25 are in operation, and the B board has 26 positions with 9 in operation. The operating organization at full load consists of 1 chief operator, 1 assistant operator, 3 A board supervisors, 1 B supervisor, 27 A operators, 9 B operators and 2 information operators. For local business a 220-amp, 24-volt storage battery has been installed, and for toll traffic a 100-amp battery, with two charging motor generator sets, each consisting of an 800-amp, 30-volt generator direct driven by a 40-hp, 220-volt, direct-current motor run by Edison service. The service meters are operated by two 2-hp motor-generator sets with a 34-volt, 25-amp generator operated by each.

Hearing on Franchise of Connecticut River Transmission Company.

The Massachusetts Board of Gas and Electric Light Commissioners gave a hearing on Feb. 3 at the City Hall in Fitchburg, Mass., on the appeal of the Fitchburg Gas & Electric Company from the franchise granted by the Fitchburg Board of Aldermen to the Connecticut River Transmission Company in that city. The Connecticut company was represented by Mr. Jeremiah F. Smith, Jr., and Mr. David I. Walsh, of Boston, and the Fitchburg company by Mr. Charles E. Ware, of Fitchburg, and Mr. Everett W. Burdett, of Boston. The case is one of the most important that has ever arisen in Massachusetts in the field of central-station relations, since it involves the defining by the commission of the status of a local company selling electricity for lamps and motors to large and small consumers, and the expediency of allowing a hydro-electric company to enter local territory for the sale of energy in bulk in competition with the established central station.

Mr. Smith said that the Connecticut River company will depend primarily on Massachusetts and Worcester County for its market. Massachusetts laws require a power company to be incorporated under the laws of that State, if it does business in that State. The capital stock is at present small—$10,000—but it will be increased as the work of transmission and distribution progresses. The company expects to furnish 16,000 kw ultimately and will probably be in a position to deliver about 2500 hp to 5000 hp in the coming spring. Mr. Smith contended that the local electric company makes lighting its chief business and the sale of energy for motors its secondary business. "The stand is taken wisely," said he, "that it is best to have but one lighting company, rather than duplicated investment and destructive competition in this field." He claimed that selling energy for motors or in bulk is a more competitive business, and that the public interests demand the sale of energy for this purpose at the lowest practicable price. The question is one bearing upon the power business alone, it was argued, and the rates will be as follows, in a general way: Large users, 150 hp to 300 hp, will pay from 1 cent to 1.2 cents per kw-hour. Small users, whose plants are located along or adjacent to the company's transmission lines, will pay from 1.2 cents to 2 cents per kw-hour, depending upon the hours of use and the ratio which the average load used bears to the maximum demand upon the system. It is pointed out that the company could not afford to deliver energy to small consumers distant from the transmission circuits at the same rates that it could supply those adjacent to the lines. These rates are quoted for continuous energy, and the rates for secondary energy, coming at off-peak hours, would probably be somewhat lower. The transmission company's chief market must be the large consumer, but on the other hand, it has always been willing to accept such franchises as seem best for the city authorities and which on appeal seem to the Board of Gas and Electric Light Commissioners to be in the public interest. In a letter setting forth these points, President Henry I. Harriman, of Boston, stated that a price of 1.1 cents per kw-hour is, for a manufacturing company operating 58 hours per week, equivalent to a rate of $25 per hp-year.

A representative of J. G. White & Company, New York, stated in response to questions by counsel for the Fitchburg company that the power of the river had not in any sense been overestimated by the transmission company. Mr. Harriman pointed out in his letter that the company will generate about 50,000,000 kw-hours of primary energy per year, and about 20,000,000 kw-hours per year of secondary energy, compared with a total production of between 3,000,000 kw-hours and 4,000,000 kw-hours per year by the Fitchburg Gas & Electric Company. He urged that this difference will account for much greater efficiency of production in the hydro-electric plant than in the steam station.

For the Fitchburg Gas & Electric Company, Mr. Burdett said that his client had no objection to the transmission company furnishing energy in bulk, for by such a course the whole community would prosper, and the local company with it. The local company does object most earnestly, however, to the sale of energy by this new organization to small consumers. If the transmission company will decide that it does not wish to take advantage of the charter of the French King Rapids Company and sell to small consumers, a great question will be eliminated. In reply Mr. Smith stated that whether the transmission company did business with small consumers or not depended upon its franchise and the attitude of the Gas and Electric Light Commissioners. Mr. Burdett asked if the transmission company would divide the motor business by agreeing not to sell in Fitchburg less than 300 hp to any consumer; but Mr. Smith felt that in order to protect the interests of the public this could not be done under the terms of the franchise already granted to the Connecticut River Transmission Company. The French King Rapids Company is owned by the same interests as the transmission company, but the peculiar geographical situation places the enterprise really in the three States of Vermont, New Hampshire and Massachusetts, and so requires separate corporate existence. Hon. James H. McMahon, who was the Mayor of Fitchburg when the franchise was granted, expressed himself in favor of competition in the motor field. The franchise would hardly have been granted with a minimum limit of 300 hp per consumer. The hearing was continued on Feb. 9.

Supreme Court Decision in the Knoxville Water Case.

The general interest in the decision of the Supreme Court of the United States in the case of the Knoxville Water Company, already noted in these pages, is such as to warrant a general statement of the conclusions reached by the court. The decision was handed down Jan. 4 and was the result of an appeal from the Circuit Court of the United States for the Eastern District of Tennessee of a case in which the Mayor and Aldermen of the city of Knoxville were appellants and the Knoxville Water Company was the appellee. The original case in which the decree was rendered was a suit in equity brought by the company, Dec. 7, 1901, against the city to restrain the latter from the enforcement of a city ordinance fixing in detail the maximum rates to be charged by the company, which alleged that the rates fixed by the ordinance were so low as to deny to the company a reasonable return upon the property employed in the business. It thereby took such property for public use without compensation, in violation of the fourteenth amendment of the Constitution of the United States. The case was tried before a master, who reported that the net income under the new rates would be less than 6 per cent on the valuation of the company's property as found by him. In the opinion of the master, 8 per cent, which included 2 per cent to provide for depreciation, was the minimum net return which the company was entitled to earn. The judge of the Circuit Court, in his opinion, confirming the report, adopted practically the master's valuation of the whole plant and property, as well as his conclusions, and issued a permanent injunction against the enforcement of the ordinance.

In its decision, the Supreme Court first holds that the ordinance, although municipal, derived its authority from the Legislature and must be regarded as an exercise of the legislative power. In such cases, the court said, it would set aside legislation only where its constitutional invalidity was very clear. The decision then takes up the question of the valuation of the property, which, according to the master, on March 30, 1901, the date of the passage of the ordinance, was $608,000. This sum was made up by adding to the appraisement of all the tangible property the sum of $10,000 for "organization promotion, etc.," and $60,000 for "going concern." The Supreme Court declined to express an opinion as to the propriety of including these two items in the valuation of the plant for the purpose for which it was valued in this case, but left that question to be considered when it should necessarily arise. Assuming them, however, to be correct, it took up the master's valuation of the tangible property which was based upon the testimony of a witness of the company as to the cost at the date of the ordinance of reproducing the existing plant as a new plant. The company contended that the master in fixing this valuation made allowance for depreciation. The Supreme Court could see no evidence to support this claim, but declared that some substantial allowance for depreciation should have been made for that proportion of the property, such as machinery, which was subject to depreciation. A witness called upon by the city placed the reproduction value at $363,000 and placed the allowance that should be made for depreciation at $118,000, or 32 per cent. In the view which the court took it did not consider it necessary to determine how much of the master's valuation of the tangible property ought to have been diminished by the depreciation which the property had undergone, except to say that there should have been considerable diminution, sufficient at least to raise the net income found by the Circuit Court above 6 per cent upon the whole valuation thus diminished. The court brushed aside the somewhat faint claim of the company that its capitalization should have some influence in determining the valuation of the property as the evidence showed that all, or substantially all, of the preferred and common stock was issued to contractors for the construction of the plant and that the nominal amount of stock issued was greatly in excess of the trade value of the property furnished by the contractors.

It was also held by the Supreme Court that the master and Circuit Court erred in estimating the gross receipts under the new ordinance. The company had been in the habit of making a discount of 5 per cent on all bills promptly paid, and this discount for prompt payment was considered in estimating the effect of the proposed rates. The Supreme Court pointed out that the ordinance required no discount. It was admitted that the abandonment of the discount would deprive the company of an efficient aid to quick collection of these bills and would add somewhat to the cost of collection, but in the case of a prime necessity like water, it considered that there were other methods of enforcing prompt payment.

In its original case, the company claimed that in fixing the value of the plant upon which it was entitled to earn a reasonable return, the amounts of both the complete and the "incomplete" depreciation should be added to the present value of the surviving plant. By complete depreciation was understood that part of the original plant which through destruction or obsolescence had actually perished as useful property. By incomplete depreciation was meant the impairment in the value of the parts of the plant which remained in existence and that continued in use. The Circuit Court refused this contention and was upheld. Upon this point the Supreme Court says: "A water plant, with all its additions, begins to depreciate in value from the moment of its use. Before coming to the question of profit at all, the company is entitled to earn a sufficient sum annually to provide not only for current repairs, but for making good the depreciation, and replacing the parts of the property when they come to the end of their life. The company is not bound to see its property gradually waste without making provision out of earnings for its replacement. It is entitled to see that from earnings the value of the property in-

vested is kept unimpaired, so that at the end of any given term of years the original investment remains as it was at the beginning. It is not only the right of the company to make such a provision, but is its duty to its bond and stockholders, and, in the case of a public service corporation at least, its plain duty to the public. If a different course were pursued, the only method of providing for replacement of property which has ceased to be useful would be the investment of new capital and the issue of new bonds or stocks. The course would lead to a constantly increasing variance between present value and bond and stock capitalization—a tendency which would inevitably lead to disaster either to the stockholders or to the public, or both. If, however, a company fails to perform this plain duty and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon over-issues of securities, or of omission to exact prices for the output, the fault is its own. The court could not undertake to correct such past errors of management.

In another part the decision of the Circuit Court was held erroneous. Although the ordinance was passed in 1901, it had never been observed, but in the meantime the company's gross income had largely increased. The decision of the Circuit Court was based on the return of the company for the fiscal year ended 1901, so that full evidence of the results for the subsequent years was not before the Supreme Court. Hence the latter was unable to say what the effect of such evidence would be, but such evidence was really relevant and it was an error to base the judgment upon one year only.

The Supreme Court decided, therefore, that the judgment of the lower court could not stand as there was an error in the appraisement of the present value of the plant, in the deduction of the reductions made by the ordinance, and in the exclusion of evidence relating to the operations of the company after the enactment of the ordinance. The Supreme Court states that its jurisdiction in cases of this kind should be invoked only in the clearest cases. In this instance more than seven years had passed since the enactment of the ordinance and it had never been observed. "If a company of this kind chooses to decline to observe an ordinance of this nature and prefers rather to go into court with the claim that the ordinance is unconstitutional, it must be prepared to show to the satisfaction of the court that the ordinance would necessarily be so confiscatory in its effect as to violate the Constitution of the United States." This same thought has been expressed in Ex parte Young, 209 U. S., 123; San Diego Land & Town Company vs. National City, 174 U. S., 739, 754; San Diego Land & Town Company vs. Jasper, 189 U. S., 439.

On the other hand, it cannot be doubted that in a clear case of confiscation it is the right and duty of the court to annul the law. Reagan vs. Farmers' Loan & Trust Company, 154 U. S., 362; Covington, etc., Turnpike Company vs. Sandford, 164 U. S., 578; Smyth vs. Ames, 169 U. S., 466. But the court did not consider the present case as being one of this kind. It says: "Upon any aspect of the evidence the company is certain to obtain a substantial net revenue under the operation of the ordinance. The net income, in any event, would be substantially 6 per cent, or 4 per cent after an allowance of 2 per cent for depreciation. See Stanislaus County vs. San Joaquin Company, 192 U. S., 201. We cannot know clearly that the revenue would not exceed that return. We do not feel called upon to determine whether a demonstrated reduction of income to that point would or would not amount to confiscation. Where the case rests, as it does here, not upon observation of the actual operation under the ordinance, but upon speculations as to its effect, based upon the operations of a prior fiscal year, we will not guess whether the substantial return certain to be earned would lack something of the return which would save the effect of the ordinance from confiscation. It is enough that the whole case leaves us in grave doubt. The valuation of the property was an estimate and is greatly disputed. The expense account was not agreed upon. The ordinance had not actually been put into operation; the inferences were based upon the operations of the preceding year, and the conclusion of the court below rested upon that most unsatisfactory evidence, the testimony of expert witnesses employed by the parties. The city authorities acted in good faith, and they tried, without success, to obtain from the company a statement of its property, capitalization and earnings."

In conclusion the court expresses itself as follows: "The courts, in clear cases, ought not to hesitate to arrest the operation of a confiscatory law, but they ought to refrain from interfering in cases of any other kind. Regulation of public service corporations which perform their duties under conditions of necessary monopoly will occur with greater and greater frequency as time goes on. It is a delicate and dangerous function, and ought to be exercised with a keen sense of justice on the part of the regulating body, met by frank disclosure on the part of the company to be regulated. The courts ought not to bear the whole burden of saving property from confiscation, though they will not be found wanting where the proof is clear. The legislatures and subordinate bodies to whom the legislative power has been delegated ought to do their best. Our social system rests largely upon the sanctity of private property, and that State or community which seeks to invade it will soon discover the error in the disaster which follows. The slight gain to the consumer, which he would obtain from a reduction in the rates charged by public service coroporations, is as nothing compared with his share in the ruin which would be brought about by denying to private property its just reward, thus unsettling values and destroying confidence. On the other hand, the companies to be regulated will find it to their lasting interest to furnish freely the information upon which a just regulation can be based. If hereafter it shall appear, under the actual operation of the ordinance, that the returns allowed by it operate as a confiscation of property, nothing in this judgment will prevent another application to the courts of the United States or to the courts of the State of Tennessee. But as the case now stands there is no such certainty that the rates prescribed will necessarily have the effect of denying to the company such a return as would avoid confiscation."

Bakelite Insulating Material.

In a paper read before the New York section of the American Chemical Society, on Feb. 5, Dr. L. H. Baekland described a certain coal-tar product having many valuable characteristics for insulating purposes. The substance has the chemical name of oxybenzyl-methylenglycol-anhydride, but is known as Bakelite. It possesses some of the combined properties of amber, hard rubber and celluloid. It does not have the flexibility of rubber or celluloid, but it is harder and stronger than either of them, withstands heat and is not attacked by any solvents nor by most chemicals. Furthermore, it is much less expensive. It is totally insoluble and infusible and does not soften even at temperatures as high as 350 C. At the temperature of melting glass it chars without entering into fusion. It can be obtained either transparent or opaque. It can be mixed with filling materials, such as asbestos, clay, wood-pulp, etc.

It is said that generators and motors can be impregnated with the raw material, and by the simple process of heating under pressure, synthesis of Bakelite will take place in or around the fibers which cover the wires of the coils and as a result the whole will be transformed into a hard, infusible, insulated mass.

Bakelite has been used for making molded insulators, which were found to possess great mechanical strength, high insulating power and the ability to withstand high temperatures without softening. Inexpensive soft wood when impregnated with Bakelite becomes as hard as ebony, and is a good insulator; it is said to be entirely rot-proof. A coating of Bakelite on wood gives a beautiful finish, which is not affected by boiling in water, in solvents or chemical solutions. The material has also been used for making self-lubricating bearings which can be molded to correct shape and size. Moreover, it has proved useful for piston packing for withstanding high-pressure steam and chemical solutions.

Single-Phase Railways.

In a pamphlet issued in connection with the electrification of the St. Clair Tunnel, a description of which was given in our issue for Nov. 14, there is given the following tabulation of the single-phase railways now in service or under construction:

The first of the American equipment to be placed in commercial service was that of the Indianapolis & Cincinnati Traction Company, in December, 1904. It is noteworthy that during the past four years almost 1000 miles of road have been equipped for single-phase service, and that the total rating of single-phase railway motors in America has reached 137,000 hp. The number of cars is 246, and of locomotives 64. The total mileage of European single-phase railways is 867.5. The predominating frequency both in this country and abroad is 25 cycles. An e.m.f. of 20,000 volts is used on one of the foreign railways, while 11,000 volts is the highest e.m.f. used in this country for railway work.

SINGLE-PHASE ROADS IN AMERICA

Name of Road	Length (Miles) of Line Electrified	Equipment: Cars No.	Cars Motors	Locomotives No.	Locomotives Motors	Line Characteristics: Type of Control Used	Voltage	Cycles
Westinghouse System.								
Indianapolis & Cincinnati Traction Co.	116	25	4–100	..	.....	Unit Switch	3300 550	25 D.C.
Westmoreland County Traction Co.	7	4	4–50	..	.....	Hand	1200	25
San Francisco, Vallejo, Benecia & Napa Valley Ry. Co.	34	2	4–75	..	.....	Unit Switch	3300	25
		8	4–100	..	.....	Hand	2200	25
Atlanta Northern Traction Co.	18	8	4–50	..	.....	"	3300	25
Warren Jamestown Street Ry. Co.	22.5	6	4–50	..	.....	"	2200	25
Long Island Railroad Co.	5	6	2–50	..	.....	"	2200	25
Spokane & Inland Ry. Co.	115	21	4–100	6	4–150	Unit Switch	6600	25
				8	4–175		550	D.C.
Erie Railroad Co.	34	6	4–100	..	.....	" "	11000	25
Fort Wayne & Springfield Street Ry. Co.	21.5	4	4–75	..	.....	" "	6600	25
Pittsburg & Butler Street Ry. Co.	33	13	4–100	..	.....	" "	6600	25
							550	D.C.
New York, New Haven & Hartford Railroad Co.	22	4	4–150	41	4–250	" "	11000	25
							600	D.C.
Windsor, Essex & Lake Shore Rapid Railway Co.	28	5	2–100	..	.....	Hand	6600	25
Grand Trunk Railroad Co. (St. Clair Tunnel)	3.5	..	.....	6	3–240	Unit Control	3300	25
Visalia Electric Ry. Co.	23	4	4–75	1	4–125	" "	3300	15
Chicago, Lake Shore & South Bend Ry. Co.	78	24	4–125	..	.....	Unit Switch	6600	25
		4	2–75	..	.....	Hand	575	D.C.
Denver & Interurban Railway Co.	46	10	4–125	..	.....	Unit Switch	11000	25
							575	D.C.
Hanover & York Street Ry. Co.	20	5	4–75	..	.....	" "	6600	25
							575	D.C.
Shore Line Electric Ry. Co. (under construction)	12	4	4–75	..	.....	" "	6600	25
Maryland Electric Ry. Co.	24	9	4–100	..	.....	" "	6600	25
Total.	662.5	172	53700 h.p.	62	55020 h.p.			
General Electric System								
Bloomington, Pontiac & Joliet Ry. Co.	19	2	4–75	..	.....	K	3300	25
Toledo & Chicago Ry. Co.	43	7	4–75	..	.....	K	3300	25
							575	D.C.
Milwaukee Electric Ry. & Light Co.	59	11	4–75	..	.....	M	3300	25
							575	D.C.
Central Illinois Construction Co.	80	20	4–75	1	4–150	M	3300	25
							575	D.C.
Richmond & Chesapeake Bay Ry. Co.	15	4	4–125	..	.....	M	6600	25
Anderson Traction Co.	20	3	4–75	..	.....	K	3300	25
							575	D.C.
Washington, Baltimore & Annapolis Ry. Co.	60	21	4–125	..	.....	M	6600	25
							575	D.C.
New York, New Haven & Hartford R. R. Co.	8	4	2–125	..	.....	M	11000	25
		2	4–125					
Shawinigan Railway Co. (under construction)	....	..	.....	1	4–150	M	6600	30–15
							600	D.C.
Total.	304	74	27400 h.p.	2	1200 h.p.			

American Summary

Mileage	966.5
Cars	246
Locomotives	64
Horse-power	137,320

SINGLE-PHASE ROADS IN EUROPE.

Name of Road	Length of Line (Miles)	Equipment: Cars No.	Cars Motors	Locomotives No.	Locomotives Motors	Line Characteristics: Voltage	Cycles
Westinghouse System.							
Brembana Valley Ry.	19	..	.....	5	4–75	6000	25
Swedish State Ry.	7	..	.....	1	2–150	3300 18000	25
Roma Civita Castellana Ry.	33	8	2–40	3	4–40	6600	25
Lyons Tramways	14	15	2–50	..	.....	6600	15
Midland Ry., England	9	1	2–150	..	.....	6600	25
Forenade Elektrisk Aktieboget	.....	1	4–50	..	.....	6000	25
Tramways De Salerne from Salerne to Valle di Pompeii	19	20	2–40	..	.....	6600	25
Thamshavn Ry., Norway	19	1	2–40	4	4–40	6000	25
Trafford Park Ry.	.....	1	4–100	..	.....	3300	25
Tergnier-Aniay (Aisne-France)	20	3	2–40	3	2–40	3300	25
Total.	150.						
Siemens-Schuckert Werke, Berlin System.							
Murnau-Oberammergau	14	4	2–100	1	2–100	5500	16⅔
Swedish State Rys.	7	..	.....	1	3–110	20000	25-15
Rotterdam-Haag Scheveninghen	19	20	2–175	..	.....	10000	..
Parma Provincial Ry.	.....	10	2–60	..	.....	.....	..
		8	1–60	..	.....	.....	..
Midland Ry., England	9	2	2–175	..	.....	6600	25
Seebach-Wettingen Ry.	12	..	.....	1	2–200	15000	25
Roma Civita Castellana	33	4	4–40	..	.....	6500	25
Vienna Biaden Ry.	20	14	4–40	..	.....	550	25
Prussian State Ry., Blarkenese-Ohlsdorf Ry. (Hamburg) (Also known as Hamburg-Altona Ry.)	16.5	6	2–125	..	.....	6600	25
Royal Prussian State Ry., Oranienberg Experimental Line	1	1	2–175	..	.....	6000	25
Mariazell Railroad	.....	..	.....	23	2–175	6000	..
Total.	131.5						

NAME OF ROAD	Length of Line (Miles)	Equipment: Cars No.	Cars Motors	Locomotives No.	Locomotives Motors	Line Characteristics: Voltage	Cycles
ALLGEMEINE ELEKTRICITATS GESELLSCHAFT SYSTEM.							
Royal Prussian State Ry., Blankanese-Ohlsdorf	16.5	54	3–115	..	.....	6600	25
Royal Prussian Experimental Ry., Orienburg	1	1	2–175	..	.....	6000	25
Stubai-Thal Ry	12	4	4–40	..	.....	2500	42
Borinage Ry	13	20	2–40	..	.....	600	40
Swedish State Rys	.	2	2–120	..	.....	6000	25
South London Line, London. Brighton & South Coast Ry	9	16	4–115	..	.....	6000	25
Niederschoneweide Spindlersfeld Ry	2.5	2	2–100	..	.....	6000	25
Prussian State Ry	112	..	.....	..	3–350	6000	25
Berlin Stadt & Ring Ry	366	..	.....	.	.....	10000	..
Total	539						
MASCHINENFABRIK OERLIKON, ZURICH, SYSTEM							
Seebach-Wettingen Ry	12	..	.....	1 1	2–200 4–250	15000	25
Locarno-Bignasco	17	3	4–40	..	.....	5500	20
Valle Moggia Ry	17	..	4–40	..	.....	5000	..
Total	46						
MISCELLANEOUS.							
Compagnie Generale Parisienne de Tramway	1	1	2–50	..	.....	500	25

CURRENT NEWS AND NOTES.

TARIFF ON RADIUM.—Congress has been asked to remove the tariff tax on radium, which is stated to render its importation in this country almost prohibitive.

THE MONTGOMERY ARCH.—A great electrical arch is being erected at the railway entrance to Montgomery, Ala., upon which will appear the name of the town in letters of light. It is desired to add an appropriate motto or "slogan," and suggestions as to this phrase are invited by the Montgomery Light & Water Power Company.

WIRELESS TELEPHONES.—Lieutenant Sweet, of the Navy, in testifying recently before the House Committee on Merchant Marine, said that the wireless telephones installed on the battleship fleet works satisfactorily in some instances but unsatisfactorily in others. He said that he had carried on conversation over the wireless telephones a distance of 12 miles.

DIRT ON GLOBES AND REFLECTORS.—The report of the January meeting of the Chicago section of the Illuminating Engineering Society, which appeared in our issue for Jan. 28, contained an error in the statement that certain tungsten lamps and reflectors that were tested had been in place for one year. In reality, the lighting units had been installed for only six weeks.

LIGHTING IN NEW YORK.—The New York Edison Company made 34,831 contracts last year for supply of electrical energy from its system, aggregating an equivalent of 2,765,616 lamps of 16 cp, consuming 50 watts. Of this number the net increase during the year was 882,989, bringing the connected load of the system up to 6,805,991 equivalents. The electric motors on the system aggregate 205,373 hp.

MANITOBA'S MUNICIPAL TELEPHONES.—Lieutenant-Governor McMillan, of Manitoba, has, according to a Winnipeg dispatch, declared the experiment of public ownership and operation of the telephone service to be a success. The service has been conducted by the government for 11½ months and a substantial surplus is reported. The extension of the system throughout the province has been vigorously prosecuted during the year and its further development will be continued with all possible speed.

STORAGE-BATTERY ACTIVE MATERIAL.—A patent issued Feb. 2 to Quinton Marino and E. W. Barton-Wright, of London, Eng., describes a process for agglutinizing active material paste for storage batteries. This consists in mixing castor oil with a small quantity of finely powdered litharge and manganese peroxide, boiling the mixture, allowing it to clarify and then decanting the liquid from the precipitate. The liquid is next dissolved in a hydro-carbon, the solution mixed with a bulk of litharge and acidulated water added to form a paste. It is claimed that with this paste less forming is required and there is increased adhesion.

COMPULSORY WIRELESS.—President Roosevelt in a message to Congress has recommended immediate legislation requiring, within reasonable limitation, that ocean-going steamers carrying considerable numbers of passengers shall carry an efficient wireless telegraph equipment. It has been urged that any legislation by Congress shall allow the substitution of the wireless telephone for the wireless telegraph on the Great Lakes. A number of amendments have been offered to one or more of the wireless measures now before Congress, and should a bill be passed at this session it will probably differ quite considerably from the terms of any of the original bills.

GUNS MADE NOISELESS.—Mr. Hiram Percy Maxim, the well-known electrical engineer, gave a very interesting demonstration of his "gun silencer," on Feb. 8, at the offices of Redding, Greeley & Austin, his patent lawyers, New York City. It was attended by a large number of technical men, rifle experts, sportsmen, etc. A shooting gallery was set up in the office with a sand bank to receive the shots, which were fired from a large variety of guns and rifles, including those of the armies of Europe. However loud the report of the discharge without the silencer, it ceased to be heard when the little appliance was screwed to the muzzle. The silencer, which varies in length from about 4 in. up to 6 in. and weighs from 7 lb. up to about 11 lb., is a steel tube with some 12 chambers through which the escaping gases of the powder are rotated so that they emerge gradually and quietly; while the bullet passes out through the central orifice with free clearance. The principle of the device is that of the "negative turbine." It is said that there is absolutely no loss of velocity, accuracy or penetration. Under the conditions, the exhibition made was most convincing.

SAFETY AND SANITATION.—The Museum of Safety and Sanitation Engineering Societies Building, New York City, is now organizing its membership subscriptions as follows: Individual, $5 per year; sustaining, $10, and commercial, $25. The individual members receive postpaid free a copy of "Social Engineering," just issuing, for which Mr. Andrew Carnegie has written a characteristic introduction. Sustaining members receive two copies, and commercial members five. This book, which includes an account of the museum work and aims, is a record of things done by American "captains of labor," for 1,500,000 employees, and is of a most helpful nature as to social and moral uplift, and the rendering safer both life and limb. The museum seeks co-operation and support in all departments of American industry, where occupational dangers and diseases are encountered and can be lessened by precept and demonstration of safety appliances. There are 10 such museums in Europe, all aided or supported by governments; this in America depends entirely on voluntary support. Dr. W. H. Tolman is director and Mr. Frank A. Vanderlip is treasurer.

NEW YORK ELECTRICAL SOCIETY MEETING.—Dr. Louis Bell will lecture on "Lighting of American Streets" before the New York Electrical Society, Wednesday evening, Feb. 17. The meeting will be held in the Engineering Societies Building, 33 West Thirty-ninth Street.

STEVENS INSTITUTE DINNER.—The alumni of the Stevens Institute of Technology will have their annual dinner on Friday, Feb. 19, at the Hotel Astor, New York. A large attendance is expected, and among the speakers will be President Alex. C. Humphreys, of Stevens Institute; Alfred Noble, past-president of the American Society of Civil Engineers, and a former member of the Panama Canal Commission, whose topic will be the "Panama Canal"; Col. H. G. Prout, vice-president of the Union Switch & Signal Company; John A. Bensel, Commissioner of the Board of Water Supply of New York City, and Col. George Harvey.

MONTHLY MEETING, A. S. M. E.—The next monthly meeting of the American Society of Mechanical Engineers in New York City will be held on Feb. 23, the fourth Tuesday of the month, instead of the second Tuesday as usual. The subject of the evening's discussion will be "Safety Valves," introduced in a brief paper by Mr. Frederic M. Whyte, general mechanical engineer of the New York Central Lines. Mr. Whyte will discuss the principles of the application of safety valves to steam boilers, with special reference to locomotive practice, including questions of design and construction, and the requirements and limitations of valves. His paper will be followed by a general discussion covering marine and stationary practice and conditions existing in connection with low-pressure heating boilers.

INSTITUTE ANNIVERSARY DINNER.—The American Institute of Electrical Engineers will celebrate the completion of its first quarter of a century with an anniversary dinner at the Hotel Astor, New York City, March 11. The annual dinners of the Institute have always been extremely successful, while the historical character of this affair promises to make the occasion more than usually interesting. President Ferguson has appointed Mr. T. C. Martin chairman of the dinner committee; the other members appointed are: Messrs. T. Beran, M. Coster, M. M. Davis, H. A. Foster, G. A. Hamilton, R. T. Lozier, W. McClellan, F. A. Muschenheim, H. W. Pope, C. W. Price, F. A. Scheffler, E. A. Sperry, A. Spies, A. Williams and G. H. Guy, secretary. The committee is already busily engaged making its plans and arrangements.

THE NEW HAVEN SYSTEM.—Under the escort of Mr. W. S. Murray, chief engineer, a party of technical journalists representing the chief engineering and mechanical papers made a trip of inspection on Feb. 5 over the New Haven Railroad system as far as Stamford, Conn., riding there and back on the Westinghouse electric locomotives hauling regular trains. The fullest opportunity was afforded to inspect every detail under conditions of actual operation, both on the locomotive and on the track, whether with direct or alternating current, and whether with the overhead catenary construction or the hooded third-rail. The observations thus made were most satisfactory as to the smoothness of operation and adhesion to schedule. A visit was also paid to the machine and repair shop at Stamford, where surprise was expressed by many at the fact that so little provision of the kind was needed.

WISCONSIN SOCIETY OF ENGINEERS.—It is proposed by 40 or more engineers in Wisconsin, representing cities, public utilities, manufacturing plants and colleges, to organize a State society along the same lines as those which are now in existence in Illinois, Indiana and other States. The purpose of this society is to get the engineers of the State better acquainted with each other, to get a better understanding of problems that are of mutual interest to all, and to discuss some of the leading municipal and other problems of the day. It is proposed to hold the first meeting in Madison in the Engineering Building at the University on Feb. 24, 25 and 26. Prof. F. E. Turneaure, dean of the College of Engineering, is chairman of the program committee, and W. G. Kirchoffer, of Madison, is secretary of this committee.

ANOTHER EPOCHAL INVENTION.—A correspondent sends an account of an invention whereby, he says, the current within a conductor may not only be maintained, but the "amperage" actually increased along the line. "The device is extremely simple and is easily applied by being placed on line poles 50 miles to 100 miles apart, when it will increase the power on the line so as to propel cars and trains and also for electric lighting, telegraphing, etc. Its principle of working is to pump the magnetism from the air and draw it on to the live conductor, thereby strengthening and maintaining the original current starter from the dynamo or battery. This idea was induced in my mind by a simple physical fact that I know but which is usually overlooked. I am imbued with the belief that electricity has its source in the aerial ocean, as water in the terrestrial ocean, and that electricity and magnetism are one and the same element, differing only in manifestation."

BIRMINGHAM ELECTRIC RAILWAY EMPLOYEES.—Consul Albert Halstead, of Birmingham, reports that the tramway committee of the City Council has decided to reduce the hours of the employees on the electric street railway system from 60 to 54 per week. It was argued that the reduction of the hours by 10 per cent would result in the employment of about 150 more men, the number under the 60-hour schedule having been 1523. The additional cost has been roughly estimated at about $19,466 per year. A new wage scale fixes lower pay for the first five years of employment, which may make the reduction of hours less costly to the city than it had been anticipated. Motormen have been paid on the following basis: First year, $7.29 per week; second year, $7.66; third year, $8.02, and the fourth year and maximum, $8.26 per week. New motormen will be paid first year, $6.68 per week; second year, $7.05; third year, $7.41; fourth year, $7.78; fifth year, $8.02, and thereafter $8.26 per week, bringing the maximum pay for new motormen with the sixth year up to what the old men get with the beginning of the fourth year. Conductors will receive for the first year, $6.08 per week; for the second year, $6.44; third year, $6.80; fourth year, $7.05; fifth year, $7.29, and thereafter $7.54 per week.

SOCIETY OF HUNGARIAN ENGINEERS.—A number of Hungarian engineers and architects pursuing their professions in the United States have organized the "American Society of Hungarian Engineers and Architects." The society has two objects. First, to bring in closer touch engineers and architects of Hungarian extraction, living in this country, and to give moral support and information to newcomers. Second, to encourage the exchange of engineering, technical and industrial information between the technical men of Hungary and of the United States and to foster technical societies, sciences and industries. The society will hold monthly meetings where papers will be read and discussed. The membership consists of mechanical, electrical and civil engineers, chemists, architects and craftsmen. Following are the officers of the new society: President, A. Henry Pikler, M.E., member of the American Institute of Electrical Engineers, engineer in charge of transformer department, Crocker-Wheeler Company, Ampere, N. J.; vice-president, Karoly Z. Horvay, architect, chief draftsman, Building Bureau of Board of Education, Brooklyn, N. Y.; secretary, Zoltan de Nemeth, M.E., New York Edison Company; treasurer, Sandor Oesterreicher, E.E., Associate Member of the American Institute of Electric Engineers and of the American Society of Mechanical Engineers, New York Edison Company; assistant secretary, Ernest L. Mandel, B.S., C.E., Bureau of Commissioner of Public Works, New York City. The society's business address is Box No. 1031, New York City.

The Urft Valley Energy Transmission Plant.

A REMARKABLE dam, the largest in Germany, has been recently completed at a cost of $2,500,000, for raising the low-water mark of the Urft River region, thereby avoiding inundations which formerly were of very frequent occurrence, and at the same time providing for a source of energy that might be able to supply a district about 25 miles in radius with electricity for lamps and motors from a central power station.

The embankment was erected from rubble and concrete, and reinforced at the foot with earthwork, according to plans by the late Dr. Otto Intze. It is 1100 ft. in length and 177 ft. in height, constituting a reservoir 187 acres in area and 60,000,000 cu. yd. in volume, the water depth on the walls being 174 ft. A penstock about 9200 ft. in length, intended for supplying the accumulated water to a hydro-electric power house, situated near Heimbach on the River Ruhr, is branched off at about 1 km to the north of the embankment, which comprises two overflow channels. The water available for conversion into electrical energy suffices to generate 4800 hp during 7200 hours per annum. However, as a yearly operation of only 4000 or 5000 hours must be taken into account, the machinery could be designed for a far larger output.

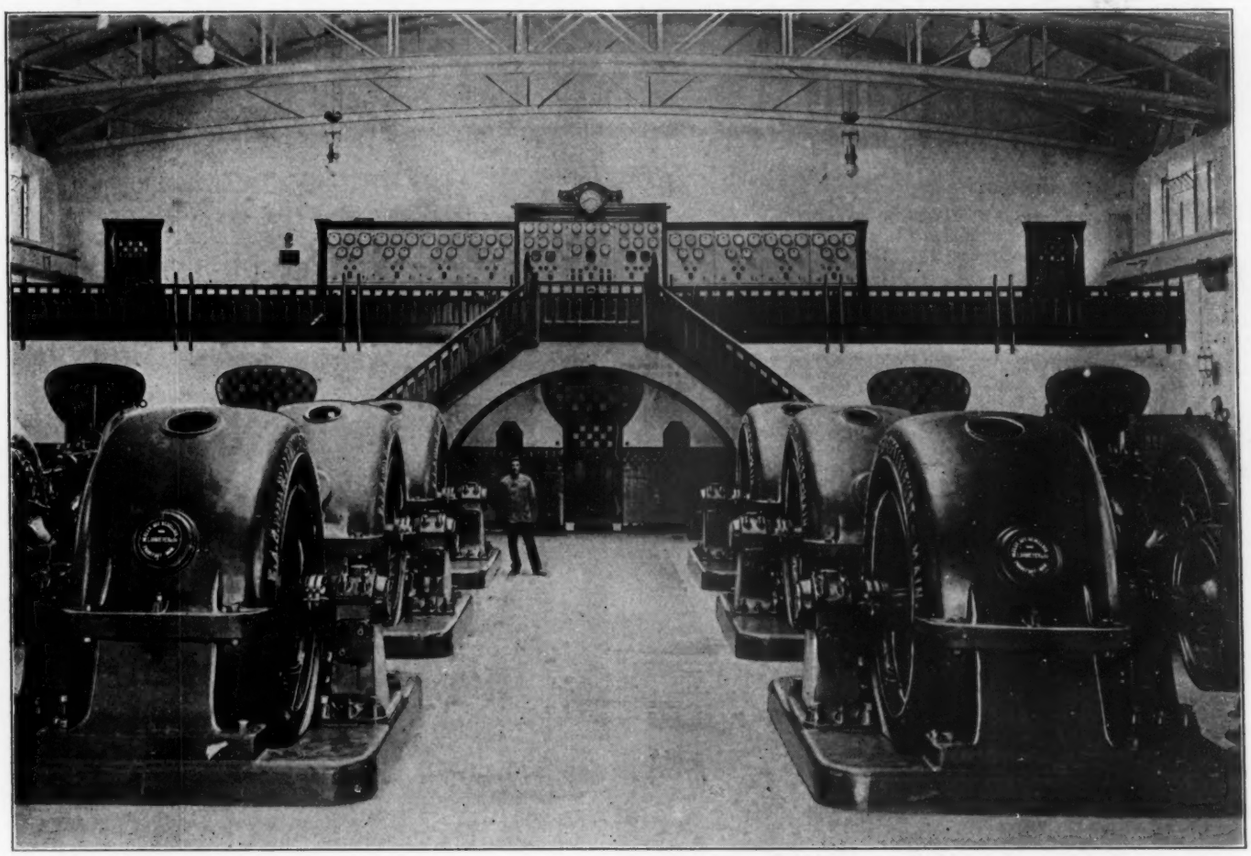


FIG. 1.—INTERIOR OF HEIMBACH GENERATING STATION.

The construction of the penstock was extremely difficult, largely because clay-slate layers were encountered at certain places. It was drilled partly by hand and partly by electrically operated drills from both its ends, energy for the operation of the drills, as well as for the construction of the embankment, being supplied by a local station at 1200 volts. The penstock during construction had to be ventilated and drained artificially, the pressure-head being only 6.5 ft.

The power house is situated on the River Ruhr, 700 ft. above zero level. The engine room is 99 ft. in clear length and 75 ft. in clear width. A transportable hand-operated 8-ton traveling crane covers the engine room, close to the switchboard. The latter is arranged at the gable wall, situated close to the mountain slope, on a platform to which access is obtained from the engine house through a double staircase. Below the switchboard are situated the offices and storerooms, and behind these the transformers, while the high-tension switch-gear and fuses are arranged in the upper stories.

The power house has been designed for eight 2000-hp sets, only six of which have been installed. These are arranged symmetrically in two parallel rows of three each, care having been taken to locate the turbines close to the walls of the building, and the directly coupled generators are placed toward the middle of the room. The small exciter turbines and generators are situated in front of the switchboard.

Francis pressure turbines for a head of 110 m were adopted, the head being, however, subject to considerable fluctuations and running as low as 70 m. Each of the main turbines weighs 15 tons, inclusive of accessories, and with a maximum head of 110 m can yield an output of 2000 hp at 500 r.p.m., while giving as much as 1550 hp with a minimum head of 70 m. The normal output of 2000 hp can, however, be obtained for heads as low as 85 m, below which the head does not fall under normal conditions.

The supply pipe of each turbine is 0.80 m, and that of each exciter turbine 0.30 m in interior diameter. All of these pipes have been tested at one and one-half working pressure. The main gates of the turbines are arranged in the horizontal portion of the supply pipe, which is situated below the floor of the engine house, while being actuated from the latter by water. Those of the exciter turbines are operated by hand.

The water after entering the turbines radially issues in an axial direction. The turbine wheels are of magnesium bronze and are 0.95 m in external diameter. The guide-vanes are made of steel, and are moved either by hand or automatically through hydraulic governors. Of the two turbine bearings, the outside one has been designed as a thrust bearing, both being pro-

vided with ring lubrication. The bearings, turbine housing and two discharging pipes rest on a common base plate; the shaft at the dynamo end is 180 mm in diameter. The two small turbines of the exciter dynamo are identical, each being designed for 200 hp at 900 r.p.m. Their wheels are 0.56 m in diameter. These turbines are provided with the same type of speed governor as the main turbines.

The arrangements for regulating the load and speed mainly comprise a motor for adjusting the guide-vanes in accordance with the turbine load. This motor is fitted directly to the tur-

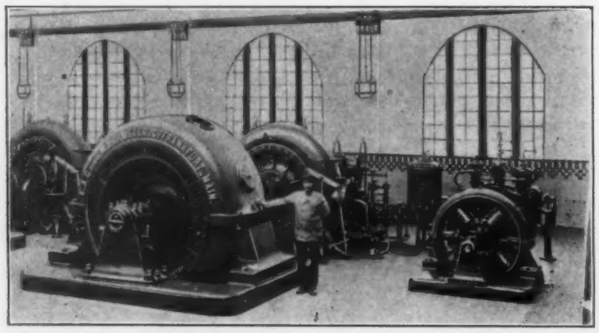


FIG. 2.—EXCITATION SET AND GOVERNOR MECHANISM.

bine housing, and the governor, operated through belt transmission from the turbine shaft, is arranged on a special jack with separate base plate, to the left of which is fixed the vertical cylinder of the self-acting regulating valves actuated from the governor through lever transmission. The position of these valves determines the position of the motor. However, the guide-vanes, if desired, can be operated by means of a hand-wheel. In order to allow the generators to be connected in parallel from the switchboard, there has been provided a special arrangement for shifting the regulating valves within certain limits, comprising a small electric motor, operated from the switchboard, which transmits its motion through a worm and worm-wheel to a spindle adjusted by hand and on which the regulating lever is mounted.

In addition to these arrangements there has been provided a regulator of excess pressure, comprising a cylinder locked by a slide valve, and which communicates with the supply pipe of the turbine, the slide valve being connected through levers to the

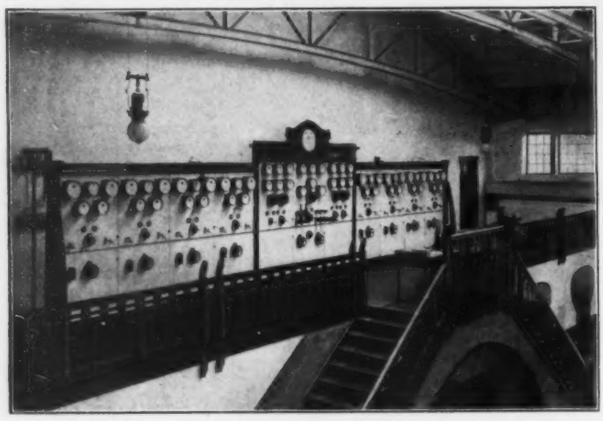


FIG. 3.—SWITCHBOARD AT POWER HOUSE.

remaining regulators. The pressure regulator is actuated automatically as soon as an excess in pressure is produced in the pipe as a consequence of a sudden locking of the guide-vanes and by allowing the water to escape immediately from the turbine supply pipe into the pond, prevents any disastrous effects of the pressure occasioned by the kinetic energy of the water. It may be mentioned that all of the pressure water required for actuating the regulators is cleaned before being used.

The following conditions were stipulated for these turbines: In case of sudden fluctuations in load of 10, 25 and 30 per cent, the corresponding variations in speed should not exceed 2, 3 and 4 per cent, respectively, and the fluctuations in e.m.f. should not exceed 1.5, 3 and 5 per cent, respectively; the time of closing the regulators, from full aperture to full closure, should not be more than two seconds.

These conditions were entirely complied with during tests made on delivery, when a maximum head of 360 ft. was available.

The main generators, producing three-phase current at 50 cycles, were designed by the Felten & Guilleaume Lahmeyer-Werke, Ltd.; they are coupled to the turbines through elastic Zodel-Voith clutches.

The rotor of each generator is designed as a flywheel, comprising 12 pole cores of oval cross-section, to which substantial pole pieces are bolted. The field coils are built of flat copper windings wound on edge. The exciting current is supplied through slip-rings and carbon brushes. The stator coils, which were made by hand, are located in half-open slots lined with

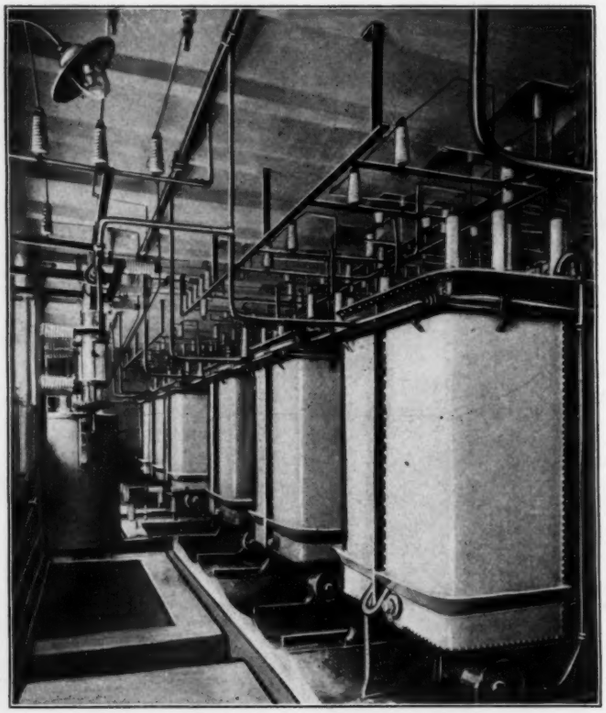


FIG. 4.—TRANSFORMERS, WATER-JET GROUNDING DEVICES AND EXCITER RESISTORS.

mica tubes. All terminal connections were carefully wound on forms. The windings are protected by perforated shields against accidental contact or damage.

The two exciter machines are four-pole, direct-current, interpole shunt machines. The main data of the two types of generators are recorded in the following table:

	Three-phase generators.	Exciter generators.
Output, kw	1,600	135
E.m.f., volts	5,000	225
Speed, r.p.m.	500	900
Armature diameter, mm	2,500	540
Armature width, mm	800	220
Armature bore, mm	1,700	226
Field bore, mm	....	550
External diameter of magnet wheel or pole housing, mm	1,662	1,500
Number of poles	12	4
Armature resistance, ohm	0.121	0.0066
Weight of rotary part, tons	7.7	0.85
Weight of machine, inclusive of shaft and base plate, tons	33.0	4.9

The e.m.f. is regulated in steps of 50 volts, the exciting current being 77 amp with full load, at 1360 kw with 5400 volts and cos $\Theta = 0.85$. The increase in tension was guaranteed not

to exceed 14 per cent in the event of the full load being cut out, the excitation and speed remaining unaltered. Alterations in speed with sudden fluctuations in load of 15 per cent are 2.5 per cent as a maximum.

The switch-gear, which was constructed by the Siemens-Schuckert Works, is arranged at the rear of the gable wall of the building. The switchboard, which is made up of marble plates mounted on substantial iron frames, is located on an elevated platform and contains all measuring instruments and accessory switches for operating the high-tension switches of the generators and transmission lines, as well as any regulators for the main generators and exciters, all these being low-tension apparatus, whereas the generator fuses and the instrument transformers for measuring the generator output are fitted on iron frames in the room situated below the switchboard. In the same room terminate the 5000-volt cables coming from the main generators, which are continued as bare copper conductors

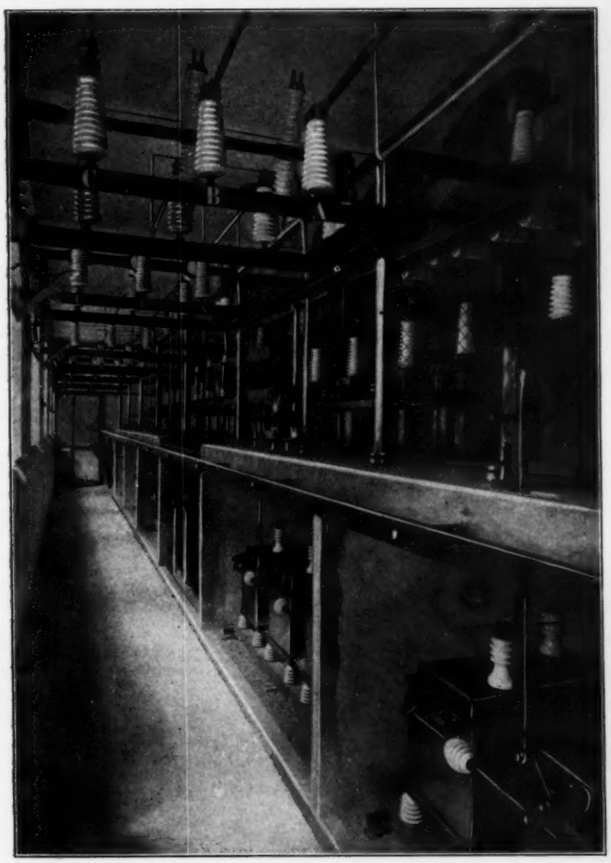


FIG. 5.—HIGH-TENSION OIL-SWITCH WITH SWITCH MOTORS AND BUSBARS FOR 35,000 VOLTS.

—through the intermediary of the apparatus just mentioned—toward the transformers arranged behind this room.

To accommodate the present number of main generators there are provisionally installed six transformers of the water-cooled oil-insulated type, located on small trucks so as to be readily removable for repair. The output of each transformer corresponds to that of a generator, transformation being effected at a ratio of 5000 to 35,000 volts. The oil, which is kept in circulation by a small centrifugal pump, reaches a maximum temperature elevation of 50 deg. C. in the case of a continuous full load. From the 35,000-volt terminals of the transformer conductors are led through the ceiling to the transformer room toward the automatic high-tension oil switches, which are installed on a platform above the floor of the switching room in masonry niches. The transformer switches are arranged in a similar manner, opposite those of the outgoing transmission lines, an operating passage being provided between the two rows. High-tension busbars, susceptible of being separated into several portions by sectional switches, are arranged alongside the two longitudinal walls so as to be inaccessible to any accidental contact. To these busbars are connected the conductors of the transformer switches of the high-tension transmission lines. Three pairs of horizontal busbars for the horn lightning arresters and choke coils belong to the earthing and

FIG. 6.—SWITCHROOM FOR 35,000-VOLT APPARATUS.

high-tension safeguards, for which water or oil resistors are used as earthing devices. The water-jet earthing devices, situated in the transformer room close to the walls of the building, are directly connected to the high-tension busbars and serve for leading any statical charge liable to result in excess e.m.f. down to the ground without causing any damage.

Of special interest among the apparatus used in connection with the switchgear are the high-tension oil switches and the arrangements provided for their operation. Cut-outs in high-tension plants should be installed at considerable distance from the switchboard, intermediary devices being used for actuating the cut-outs from the board. These devices can be designed as lever or belt transmission, but the mechanical operation, apart from being complicated, is entirely unfitted for certain cases. A more satisfactory solution of the problem is afforded by electrical long-distance operation, which has been adopted in the present case. Each of the oil switches used for the machinery as well as for the outgoing long-distance transmission lines comprises three single-pole oil switches, arranged beside

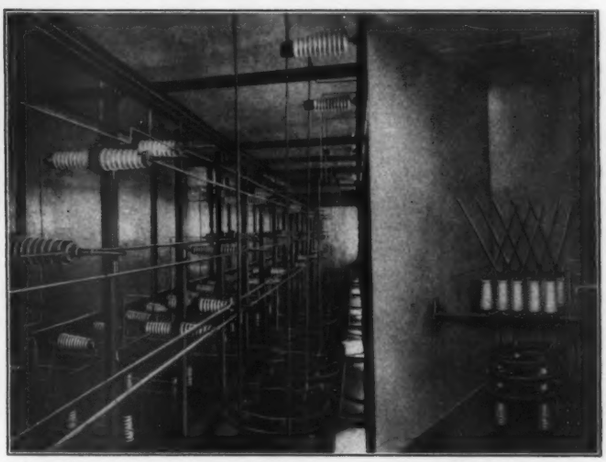


FIG. 7.—ARRANGEMENT OF TRANSMISSION LINES WITH CHOKE COILS AND GROUND BARS.

one another and connected together by a clutch rod so as to be operated in common.

In making the selection of switches it was held that oil switches are especially valuable for high-tension plants since they take up less space than open-air lever switches, while being more readily adapted to the general arrangement of the plant and giving no open arcs on being cut out. A special advantage

is that oil switches will interrupt the current without giving rise to any objectionable excess in e.m.f.

The switches are placed in entirely enclosed housings through the upper part of which enter the leads to the inside contacts through suitable porcelain fittings. All current-carrying parts are situated below the oil, which will put out immediately any arc produced in switches. Porcelain is used exclusively as the insulating material.

The switches are operated by electric motors—installed on the top of the switches—which transmit their motion to the clutch-rod through a vertical wooden rod acting on a pinion. The motor is a continuous-current series machine with two coils on the magnet core, by the alternate operation of which the rotation of the motor to the right or left is obtained. The motion of the motor is transmitted through a worm-gear to the switching shaft proper, which, owing to a conveniently arranged stop, is able to perform rotation through only 180 deg. In addition to being actuated by hand, the switch motor can be thrown into circuit automatically through a relay into which the various high-tension conductors are fitted. The relays themselves are connected in parallel to the hand controllers and are designed as overload relays with timing device.

The transmission line comprises, in addition to the 35,000-volt conductors, those for 5000 volts and low-tension distribution lines for the consumers. The aggregate length of the high-tension lines at present is 105 miles, and that of the low-tension lines 147 miles. Oil switches are used for the cutting-out of conductors and transformers of the transformer stations. The latter are equipped with devices for ascertaining whether any one of the conductors is under tension and to reduce the e.m.f. from 35,000 volts down to 5000 volts. Switching cabins are used for cutting-out some given conductors, thereby effecting any connection required in the case of local disturbances. A number of the motors installed in the industrial district are operated directly at the line e.m.f. of 5000 volts.

The insulators, which are of the brown-glazed type, constructed by the Hermsdorf Porcelain Factory, are made of two parts. Each of these was tested at the factory in a water bath at 100,000 volts. Discharges between the conductors and supports will take place at 105,000 volts in the dry air, and at from 61,000 to 78,000 volts in the case of rains of different intensity. The telephone lines are arranged on the same poles with and below the high-tension conductors.

As most of the centers of consumption are situated at a considerable distance from the power house, such a high tension had to be adopted for transmission. Notice boards fitted on the poles draw the attention of passers-by to the danger connected with touching the conductors. All other usual safety devices have also obviously been provided.

Street Lighting in Rio de Janeiro.

By A. H. Keleher.

THE principal street of the Brazilian metropolis is the Avenida Central, a most beautiful avenue. It is a well-paved and well-kept street running through the heart of the business district, which has the distinction of extending from sea to sea, although it is only one mile in length.

The accompanying illustrations of the Avenida give one a very good idea of the lighting of this important thoroughfare. Extending down the center of the avenue are arc lamps spaced about 100 ft. apart and multiple incandescent mantle gas lamps on posts similarly placed, but on both sides of the street; these lamps combined produce an illumination which allows no dark spots to be observed by the most critical eye. The arc lamps are 7.5-amp series enclosed with opal inner and clear outer globes, and the current supply is 50-cycle alternating, as is all of the city lighting current, which is supplied by the Rio de Janeiro Tramway, Light & Power Company, a Canadian corporation. Each post is of beautiful design and is equipped with three arc lamps. There are 51 of these posts along the avenue; one of these posts carries five lamps, however, making a total of 155 lamps.

FIG. 3.—WATER-FRONT LIGHTING.

FIGS. 1 AND 2.—LIGHTING AVENIDA CENTRAL, RIO DE JANEIRO.

The arcs illuminate the center of the street, while the gas lamps illuminate the sidewalks. The lamp posts for the incandescent burners are placed directly opposite each other on each side of the street and half way between two posts; the spacing then is the same as the electric lamps, 100 ft. apart. It should be noted that this spacing of the lamps provides a light source every 50 ft. which accounts for the excellent distribution of illumination. As each post supports five lamps, there are 10

gas lamps to every three arcs. On Sundays all of the arc lamps are lighted until 1 a. m., after which the two lower lamps are turned off and the top lamp used until morning—on week days the two lower lamps are used till 1 a. m., when they are extinguished and the top lamp lighted. The gas lamps burn continuously throughout the nights of the week.

Some idea of the large number of lamps on the Avenida can be had when one considers the fact that in one ordinary block there are 15 arc lamps and 50 Welsbach burners, or a total of 65. Even when compared with other examples of good street lighting this is quite extraordinary. The shop lighting contributes but little to the lighting of the Avenida, as there are only a few brilliantly lighted stores open at night, and electric signs have as yet not made their appearance in large numbers. However, there are occasional cinematograph establishments equipped with flaming arcs on the outside which afford patches of light along the street. It should be stated here that in the near future many large signs will be installed which will add to the brilliancy of the Avenida at night. The people are beginning to become interested in electric signs, so that the time is now ripe for building up a business in them.

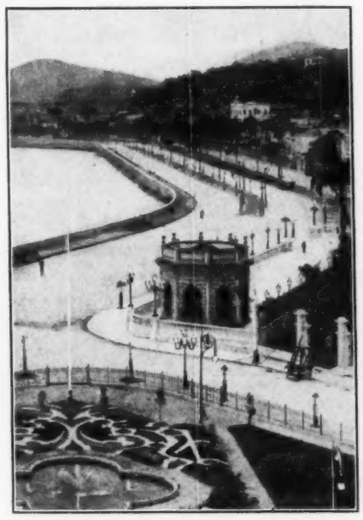


FIG. 4.—WATER-FRONT LIGHTING.

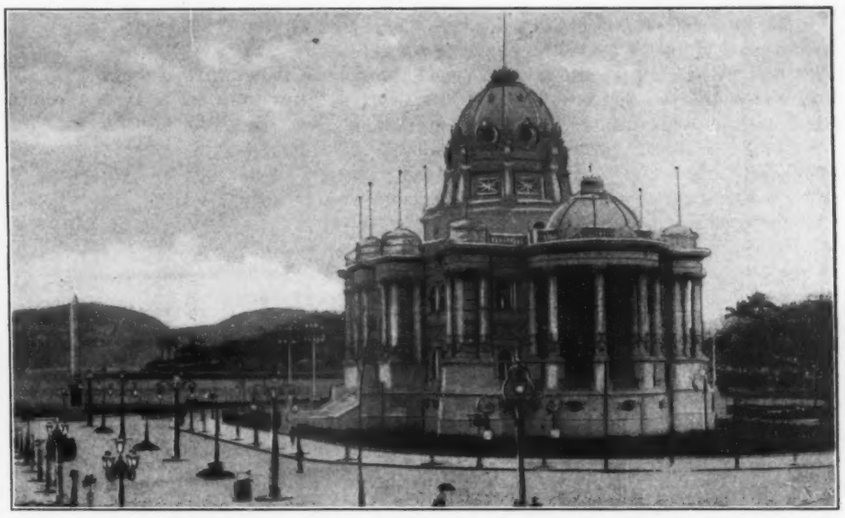


FIG. 5.—MONROE PALACE.

FIG. 6.—ORNAMENTAL LIGHTING MONUMENT.

Next in importance to the Avenida is the harbor front, which extends for five miles, beginning at the lower end of the Avenida at Monroe Palace and extending to and through the exposition grounds to the sea. Figs. 3, 4 and 5 show sections along the harbor front of this driveway, which is really a continuation of the Avenida Central, the lighting scheme of the Avenida being largely followed thereon. On Praia Botafogo, which is one of the most beautiful sections of the waterfront, there are three rows of arc lamps, making in all about 200 lamps. The park system of Praia Botafogo, which borders the bay, is paralleled by a street which is used for heavy traffic and for a line of street cars. This street is lighted by rows of single-lantern Welsbach burner posts, which line both sides of the street. Automobiles and light pleasure vehicles can use the driveways to be seen in the illustration. In the center can be seen the bridle-path, which extends through the entire length of the waterfront park system from Monroe Palace to the Avenida Saudade. There are 587 arc lamps on the Avenida Central and the waterfront combined, the latter extending from the end of the Avenida to the exposition grounds, a five-mile drive along the waterfront. In addition there are spaced at regular intervals along the driveway from Beira-mar to Avenida Botafogo 1400 mantle burners.

The building shown in Fig. 5 is the Monroe Palace, named in honor of President Monroe, and now used by the government for important conferences. It is considered the most striking building in Rio outside of the new Municipal Theater, which cost in round numbers $5,000,000; its stately appearance and beauty of design are worthy of comment. On special occasions the building is lighted very simply but effectively by means of two chandeliers, each made up of 150 16-cp incan-

FIG. 7.—AVENIDA DO MANGUE.

descent lamps, eight arc lamps at each entrance and nine in the grounds surrounding, in addition to the illumination from arcs on the street and pavements. The chandeliers are located one in the circular bay in the foreground and the other in the remaining bay in the rear of the building. It is seen that the lighting of the exterior of the building is of the simplest, but the effect is magnificent at night when the lights are burning and the white light from the arcs is shining on the pure white and cream colors of the building.

While the principal streets of the city are illuminated by electricity, the lighting of the remaining streets is confined to gas. This type of lighting is seen in the Caes Pharoux. Gas lighting is also used on the Rua Ouvidor, "the Nassau Street of Rio," and on Ruas Carioca, an important thoroughfare. On Ouvidor the Welsbach burners, suitably enclosed, are supported by brackets of graceful design, 50 ft. apart and staggered. This street is so narrow that upright lamps would interfere seriously with the traffic. On these streets, especially on Ouvidor, there are many arc lamps, including flaming arcs, hanging in front of the stores. Occasionally a tungsten cluster-body equipped with a 16-in. prismatic reflector is to be seen, and all contribute appreciably to the illumination of the street. The posts for gas lamps on these streets carry from one to three lamps, depending on the importance of the street; they are very artistic and of local manufacture.

Ornamental monuments, like the Lampadario at Largo de Lapa, are quite frequent in Rio. This particular monument is equipped with eight multiple 120-volt, 75-amp, 500-watt alternating-current arcs and 100 16-cp incandescents festooned around the top of the column and the surmounting globe. (See Fig. 6.) Only part of the arcs are lighted nightly, the whole effect being reserved for special occasions.

Fig. 7 shows the beautiful Avenida do Mangue and its lighting. Though at present gas is the illuminant, it is likely that in the near future arc lamps will be installed. The Avenida do Mangue excels the Avenida Central in its natural beauty and is rapidly becoming a popular driveway.

Automatic Electric Railway Signals.

By Wm. K. Waldron.

With the advent of high-speed electric trains came the demand for new safety devices, most important among which were the track signals. Previous steam railway experience had evolved the automatic block system, which, eliminating the personal equation, had dispensed with one great source of danger; the electrician, profiting by this experience, has applied the automatic block principle to the electric railways, and has brought forth the automatic electric block signals. These signals during the past few years have been developed to such a high degree of efficiency that they are rapidly being installed at all dangerous points on the electric railroads, subways and elevated lines, giving entire satisfaction as to protection of life and property, economy of time and low cost of maintenance. These three conditions being the sum total of the requirements of this branch of railroad equipment, one can readily foresee that these systems are assured of a greatly extended utilization in the near future.

This development has gone on so quietly that but few, even in the engineering profession, are familiar with the principles involved or the details of construction.

Expert signal men are scarce, and as the demand for electric signals is increasing year by year the electric signal business promises to be a very fair field for the electrician.

The writer has been engaged in the installation and maintenance of this class of signals for a considerable length of time, and can vouch for the efficiency of these machines. An accurate record of a large equipment of electric signals was kept for a period of one year, which showed the number of signal operations was over 230,000,000, while the number of failures was something over 800, less than one failure for every 250,000 trains passed.

Like all classes of equipment, there are several types or designs of automatic electric signals; one type only will be described in this article, as an attempt to include too much at one time would tend to confuse rather than instruct.

The principles involved are to a certain extent similar in all types and a thorough comprehension of one will enable the student to soon acquire an intelligent understanding of the others.

The type selected for the present article is known as the "Solenoid," which is operated on third-rail, direct-current track circuits and is built by the Union Switch & Signal Company, Swissvale, Pa.

The general appearance of these signals can be seen from the illustrations. Fig. 1 is a side and rear view showing the semaphore at "proceed" position, the spectacle casting being hidden by the cast-iron box containing the lights. Fig. 2 shows a front view of the machinery case with the door open and showing the cast-iron frame supporting the solenoid coil, circuit-breaker and dash-pot, as well as one of the resistance tubes.

The machinery operating the signal is located in a cast-iron

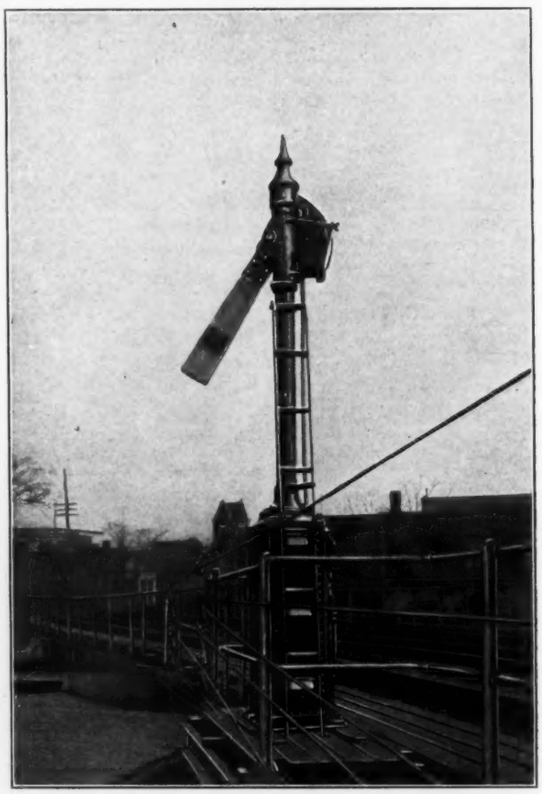


FIG. 1.—SEMAPHORE AT "PROCEED" POSITION.

case forming the base of the semaphore post. The arrangement of this machinery can be seen in Fig. 2 and the wiring is shown diagrammatically in Fig. 3, which will be described later.

The foundation principle of the block system is, of course, the "block," which is simply a section of track so protected that but one train can be in that section at any given time, no other train being allowed to enter the section until the last wheel of the previous train has passed over the release end of the block. This block section of track can be as long or as short as conditions may demand, depending on the speed of the trains, length of trains and distance required to stop a train. Fig. 3 shows a diagram of the track connections and block rail with signal indicated at *A*. The arrow indicates the direction of traffic. *A* indicates the position of the signal and entrance to block, *B* indicating release end of block; thus *A B* is the length of the block. The reader will note that one rail is marked "block rail." This is a section of track rail which is

insulated from the rest of the track by insulating joints at the entrance and release ends of the block. The other track rail is called the "common" rail and serves as return (ground) for all signals as well as motive-power current. Both of these rails must be well bonded.

At the release *B* end of the block is placed a resistance grid, which, as will be noted, is connected to the third-rail, common rail and block rail, a fuse being placed between the third-rail and the grid. This fuse is for 500 volts, 10 amp. The third-rail carries 500 volts and the block and common rails are connected to the grid so as to give a voltage of 14 volts between these two rails. This current flows back through the block rail to the entrance end of the block, where connection is made to the track relay instrument, through which it passes to the common rail as indicated in Fig. 3. A 3-amp fuse is placed in this track relay circuit as shown. Where there is no train in the block this current flows continuously, thus keeping the track relay in action. The track relay consists of a pair of small electromagnets which pick up two arms, thus completing

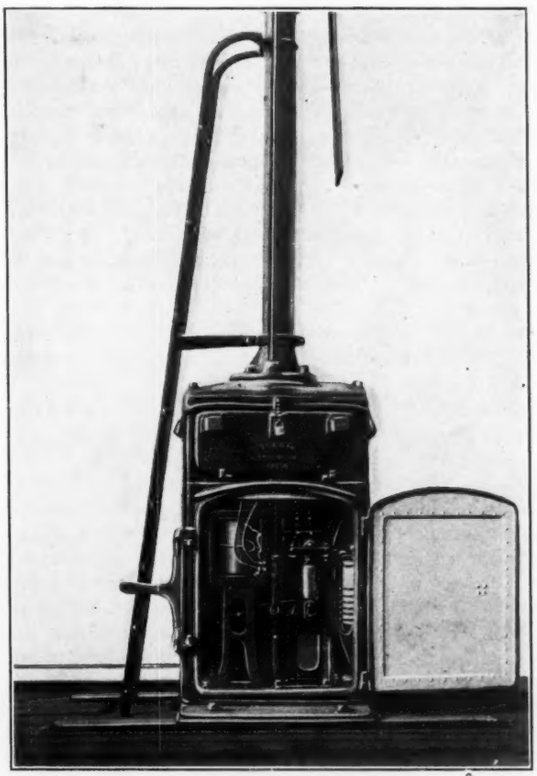


FIG. 2.—VIEW OF SIGNAL MECHANISM.

the circuit of another relay called the solenoid relay, to be mentioned later.

Referring to Fig. 3 it will be noted that a second tap is taken off of the third-rail near the entrance-end of the block and a 500-volt, 10-amp fuse is placed in this circuit near the connection to the third-rail. This circuit, after entering the machinery case, is divided into three branches, the solenoid relay circuit, solenoid circuit and light circuit, a snap switch being placed on each circuit. The solenoid circuit has a 4-amp fuse, while the other two circuits have each a 3-amp fuse inserted after the snap switch, as shown in Fig. 3. Following out the solenoid relay circuit, there is inserted a resistance tube of 1800 ohms from which the current passes through the track relay and thence to the solenoid relay, passing out to return common.

This solenoid relay is similar to the track relay, but is larger and somewhat different in construction, the principle of action being the same in both instruments. This solenoid relay completes the connection for the solenoid circuit, to be described later. As shown, the outlet of the above-mentioned 1800-ohm resistance tube is connected to another branch circuit which leads to a 1200-ohm resistance tube, after which it passes to the return common; thus when the solenoid relay circuit is broken at track relay the current returns to the common rail through the 3000-ohm resistance tubes (1800 + 1200).

Returning to the solenoid circuit, after passing through the snap switch and 4-amp fuse, the circuit leads through the solenoid relay which has been picked up by the solenoid relay circuit just described, thence through a circuit-breaker to the solenoid

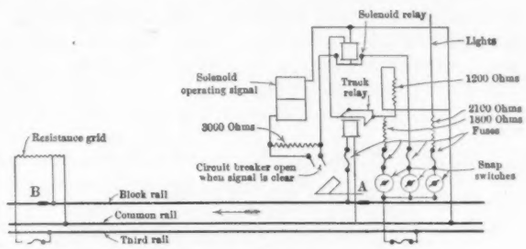


FIG. 3.—DIAGRAM OF TRACK CONNECTIONS.

coil and then to the return common. The current flowing in this circuit is 500 volts, which is required to start the lift, but not after the plunger is up. To reduce this pressure, the above-mentioned circuit-breaker is connected to the solenoid plunger, which after a given movement breaks the circuit. The current is then led off by a branch in front of the breaker and passed through a 3000-ohm resistance tube, thence to the solenoid coil and to the return common, thus reducing the current to what is required to hold up the "spectacle" casting and keep the signal "clear." The signal semaphore arm, or "spectacle" casting, is so constructed that unless balanced by the upward thrust of the solenoid plunger, the heavy or "spectacle" end will drop, thus putting the semaphore arm horizontally or to "danger."

Again turning to the light circuit, starting at the snap switch and the 3-amp fuse, the current is led through 2100 ohms resistance and up to the top of the signal post through two 6-amp fuse plugs and to two 3-cp lamps, connected in parallel.

The above description of the current flow through the track relay circuit, solenoid relay circuit and solenoid circuit is ob-

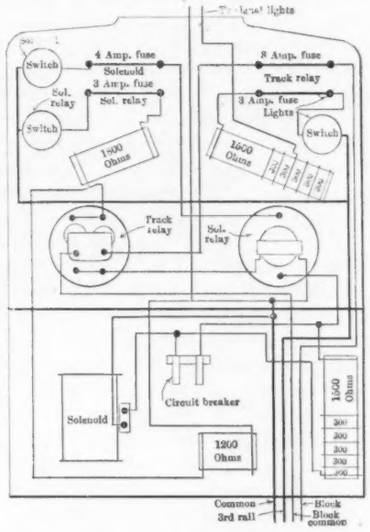


FIG. 4.—WIRING OF SOLENOID SIGNAL.

tained when the "block" is clear; as soon as a train enters the "block" the track relay circuit is short-circuited through the wheels and axles of the train. The track relay then drops, breaking the solenoid relay circuit, which in turn breaks the solenoid circuit, allowing the solenoid plunger to fall and the signal semaphore to go to "danger."

The machines, while appearing very complicated at first glance, are, in fact, extremely simple, and require but little at-

tention after all the parts are properly adjusted and all the connections properly made.

There are many lines of electric railways where speed is the main consideration. On such roads where the track is straight and the view unobstructed, there is but little danger from rear-end collisions, but all curves and other points of obstructed view must be protected by signals. To provide this protection is the special mission of these signals, and the manner in which they have filled their mission has fully justified the highest hope of their inventors.

The four lines of the Manhattan (Elevated) Railway are equipped with the above-described type of solenoid signal, which the writer believes was the first permanent installation of this type.

An English Patent Decision of Importance to American Inventors.

BY AN ENGLISH BARRISTER.

A decision of considerable importance to American inventors who own English patents, but do not work them in the United Kingdom, has recently been pronounced by the Comptroller-General of Patents in England. As readers of this journal are aware, the English law of patents has recently been changed so as to compel every patentee to work his patent in that country (see *Electrical World*, page 348, Aug. 15, 1908). Thus it was provided by the Patents and Designs Act, 1907, that at any time not less than four years after the date of an English patent and not less than one year after the passing of the act (that is, a year after Aug. 28, 1907), *any person* may apply to the Comptroller for the revocation of the patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom. The Comptroller has power to revoke unless the patentee can prove to his satisfaction that the patent is worked in the United Kingdom, or gives satisfactory reasons why it is not so worked.

The first case arising under this statute was decided by the Comptroller-general on Dec. 9, 1908. He revoked two patents, and the reasons why he revoked them cause his judgment to be of the greatest moment to every owner or sole licensee of an English patent who for some reason has not worked the invention in England.

The material facts may be briefly stated: A man obtained two patents in 1900 for a process of manufacturing thin imitation stone slabs or tiles. For some time the patents have been in operation in Europe. In 1906 a Belgian company, the Société Anonyme Eternit, became sole licensees of the patents, and, therefore, so far as the above act is concerned, occupied the position of the patentee. This company built a factory in Belgium, where the process was carried on. The company did not work the process in the United Kingdom and refused to grant licenses for its being worked there. In these circumstances application was made for revocation; the question for the Comptroller to decide was whether the licensees could give satisfactory reasons for not working the process in the United Kingdom. Among the facts and arguments put forward by the licensees, the following appear to be material: They contended that, although their factory was erected in Belgium, they were in a position to meet all the demands of the British market; that if the patent were revoked it would not be possible to work the process so cheaply in England. It came out in evidence, however that a large part of the ingredients used for making the tiles came from Russia and Canada, and that unskilled labor was largely employed. The licensees also urged that they had, in fact, taken steps to work the patent in England by advertising for licensees in various British journals and by communicating with various British firms. They received, however, no reply to their advertisements. The fact that no answers were received was urged in support of the plea that there was no real demand for the tiles in England, and it was also argued that inasmuch as the object of the act was to bring about the establishment of new industries in Great Britain, it was for those who sought revocation to show that new industries would be established.

On behalf of the petitioner it was pointed out that the patentees had taken practically no steps to use the process in England. So long as the patented articles were simply manufactured in Belgium and imported into England on terms satisfactory to the Belgian manufacturers and patentees it was impossible to find out what the real demand was in England.

The Comptroller, in giving his decision, said that he had to decide whether the licensees had given satisfactory reasons for inaction. He pointed out that by article 2 of the code adopted by the International Union for the Protection of Industrial Property, patents may be revoked only when the patentee cannot show reasonable cause for his inaction. He then said: "While the bill for the act was passing through Parliament, many efforts were made on the part of its opponents and critics to define what might and what might not be accepted as reasonable causes for the inaction of a patentee. But Parliament decided to leave it to the tribunal dealing with each case, to determine after hearing the facts and arguments whether or not the patentee could give satisfactory reasons for his inaction. It is obvious that in determining this question, regard must be had not only to the interests of the patentee, but also to those of the public; and that the mere fact that it would be more profiable or convenient to a patentee to manufacture abroad than in this country cannot be regarded as a satisfactory reason for not taking the necessary steps for introducing the manufacture into this country. Otherwise no advantage would be gained in any state of the union by legislation under which patents can be revoked for non-working; because a patentee of his own accord and without any legislative pressure will naturally be disposed to manufacture where it is most profitable and convenient for him to do so."

On the evidence, he could not come to the conclusion that there was any reason why the article should not be manufactured in England.

The remarks of the Comptroller with regard to the attempts made by the licensees to work the process in this country are as follows:

"Dealing next with the question of the *advertisements* and *offers to sell* the patent rights, I cannot regard the fact that no answers were received by the patentees to them as a satisfactory reason for not manufacturing in this country. In the first place, they were not inserted or made until very near the expiration of the year of grace which had been allowed the patentees by the act; and, even if they had attracted the attention of persons who might otherwise have been willing to work the process, the fact that only a month of the year of grace remained unexpired would naturally make manufacturers less willing than they otherwise might have been to enter into arrangements with the patentees. *For anyone* acquiring the patent rights would be in no better position to defend the patents against applications for revocation than that which the patentees themselves *from whom he bought them possessed*. It seems to me impossible to hold that a patentee can relieve himself from the duty of manufacturing in this country by the mere insertion at any time of a few advertisements, and the sending round to manufacturers of a few circulars to which no replies are received. The advertisements and offers in this case were, I may say, of the vaguest description; they gave no intimation of the terms on which the owners of the patents were prepared to treat, beyond the statement that such terms would be reasonable."

The point had also been raised that the person applying for revocation was not going to work the patent himself. This was held by the Comptroller to be no ground for refusing to revoke. His views on the object and effect of the section were expressed in the following paragraph:

"It has further been contended by the counsel for the patentees that the object of the section being merely to bring about the establishment of new industries in this country, a patent may not be revoked under it unless it can be shown that the revocation will lead to the establishment of such new industries. In the present instance, if the patents are revoked, it

seems to me impossible to say that a new industry will not be established in this country where no royalties will be payable in respect of the carrying on of the process; but even if no such industry is started here, their revocation will undoubtedly have one beneficial result, for it will free the trade in the patented article and enable French and German manufacturers to import it freely into this country, the effect of which may very possibly be to reduce its price and, while in no way preventing its importation from the Belgian factory, give purchasers an opportunity of selecting for themselves between the articles manufactured there and at other foreign factories. Counsel for the licensees argues that this was not the intention of the section, but I can find nothing in the act to warrant me in coming to that conclusion. I have always regarded the object of the section as being to put a check on the practice, which was alleged to prevail very extensively, of taking out and maintaining patents in this country, not with any intention of working them here, but with the object of preventing the patented articles from being manufactured here, and from being imported by any other parties than the patentees. If, on the evidence which has been submitted in this case, the two patents in question may not be revoked, I find it very difficult to imagine any case in which a patent can be revoked under the section."

The Comptroller made an order for the revocation of the patents, subject to an appeal, if the licensees were advised to appeal to a higher court.

At the time of writing it is not known whether there is to be an appeal; but if the above decision stands, it is plain that the section of the patent act, 1907, which was under consideration will not by any means be a dead letter so far as persons foreign to England are concerned. It is made quite clear that the mere issue of advertisements in English technical journals inviting persons in England to take licenses on reasonable terms will not satisfy the requirements of the law. If he wants the protection of English patent law nothing short of actually working his patent on British soil will put the American owner of an English patent in an unassailable position.

Telephone Traffic as an Index to General Business Activity.

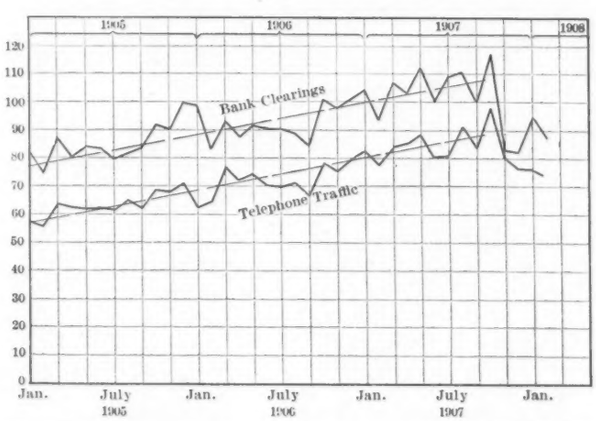
By FRANK F. FOWLE.

BUSINESS men are universally accustomed to gage the general business activity by the volume of trading in commodities which are consumed on a very large scale, such as iron, steel, foodstuffs, etc., and by the earnings of the railroads and by bank clearings. Information in this regard is spread weekly over the entire country and comparisons are made with the previous week and with the corresponding week of the previous year, in order to indicate the trend of business at the current moment. The consumption of any general commodity on a very large scale, whether it be money, transportation, building materials or manufactured products, may be regarded as showing by the weekly or monthly volume of transactions the general business activity or state of prosperity. The large public service companies now do business on so great a scale that their transactions may properly be regarded as furnishing an index to the general demand and the condition of business.

Telephone service has come to be a great public necessity and the daily use of it in messages runs into enormous figures. The total number of telephones in service now approximates 6,000,000, and the annual gross revenue is many millions of dollars. It becomes of interest, therefore, to speculate upon what the relation of telephone traffic and revenue to the general business activity may be. Telephone traffic originates in the daily course of business of almost every conceivable sort and is to the same degree cosmopolitan in its character as is the passenger traffic upon any of our great transportation systems. It originates with no particular class or community and it serves no interest exclusively. In reflecting, therefore, upon the probable sources of stimulation or depression in the telephone business, it would appear reasonable that the business must prosper in about equal measure with the sum total of other business in the community. A telephone plant is one of the greatest of modern business machines and financially its success must rest, not upon artificial stimulation or social demands, but upon the demands of commerce and its ability to serve the business man as a time-saver and a money-maker.

The writer recalls the statement of a telephone enthusiast, some eight years ago, that the telephone business had no "rainy days." This unquestionably is true with regard to such violent fluctuations as occur in some lines of manufacturing, such as steel rails, when a heavy business reaction sets in, such as that of 1907. That the telephone business, however, continues to be uniformly prosperous while general business experiences a setback seems improbable.

The writer undertook, in a small way, an investigation of this subject and made a comparison of originating toll traffic and total bank clearings in a zone having a population of approximately 2,500,000. The comparison covered a period from January, 1905, to February, 1908, and the illustration shows the relative value of toll traffic in messages and bank clearings in dollars. The general agreement between the two curves is quite remarkable; a comparison of the slopes of corresponding portions of the curves shows 30 cases of agreement and seven cases of disagreement as to direction; that is, there were 30 cases of simultaneous increase or decrease of traffic and clearings, and seven cases where one increased while the other decreased, the percentage of agreement in the total number of comparisons being 81. Aside from this detail comparison, the general similarity in growth is very noticeable, but even more remarkable is the slump in both curves with November,



RELATIVE VALUES AND FLUCTUATIONS OF BANK CLEARINGS AND TELEPHONE TRAFFIC.

1907, following the October panic. This effectually disposes, in one specific case, of the theory that the telephone business is immune from the general fluctuations of business. Local telephone traffic in the same territory fell off fully as much as the toll traffic and a considerable reduction of the operating force was possible. In the interval between February, 1908, and the present time, both clearings and traffic have been increasing slightly and are now nearly uniform with the corresponding figures for last year.

This comparison just given corroborates the theory that telephone traffic is an index to general business conditions, at least so far as bank clearings may be so regarded. This basis of reasoning would lead to the conclusion that the telephone business as a whole suffered a setback in the past year, but the reports of some companies as to earnings indicate a nearly steady growth. This fact calls forth the statement that unusually vigorous canvassing for business, the development of a large amount of new territory, important changes in rates or service, retrenchment in operating force and the deferring of maintenance or reconstruction until more prosperous times, are necessarily important factors in such a comparison when they occur in the period under consideration or a short time prior to it.

A company recently organized in a territory poorly developed, if at all, would expect a very rapid growth in normal times and during such a period as the past year would expect, not a reduction in business, but a reduced rate of increase. It is, moreover, a great testimonial to the soundness of the basic conditions throughout the country that some of these companies can show an increase in business at the present time. On the other hand, it should not be overlooked that some companies have shown increased net earnings on a reduced volume of traffic, by reason of vigorous retrenchment in the business management. Considering any territory which was fairly well developed a year ago and had not been growing at an abnormal rate, the writer believes it to be a sound theory that the telephone business has suffered the same general setback which was experienced in the demand for other public necessities.

If it be accepted as true that telephone traffic is a safe index of general business conditions, and the writer believes that the reasons for so accepting it are generally sound, the corollary to that proposition is instructive and important. It follows that with equally favorable conditions as to financing and management, the telephone business is as safe an investment as any other public service or quasi-public corporation serving the public. It follows, too, that the public demand for telephone service can be reasonably anticipated and predetermined; that it will be as stable as the demand for electric light, gas, water, transportation, etc. Much has been said and written about the value of telephone securities; a great deal of it has been in the form of attack by one of the two groups of interests engaged in the business, the Bell and the Independent companies, upon the securities of the other. The Bell companies have charged the Independents with making rates too low to provide for proper maintenance and reconstruction and give good service at a profit; the Independents have charged the Bell companies with overcapitalization and extravagance. Specific instances can without doubt be quoted to support the contentions of both sides; it would be unreasonable almost to expect that such would not be the case in any business of such vast magnitude, at the present time. The essential point to be given prominence is that with sound financing, good engineering and economical management, good service can be given at fair rates that will earn a fair return upon the investment; the demand for service is stable and, therefore, the field should have the confidence of the investor. The same careful investigation of any particular proposition before investment that is accorded to any other business is presumed here.

The Independent interests defended themselves admirably from the last attack upon their financial credit by stating that in the last five years less than 1 per cent of their companies have failed or temporarily suspended dividends. From the investor's point of view, a strong reason for withholding his confidence in the safety of telephone securities is the campaign of villification and abuse which has so long been waged between the two principal groups of interests in the business. Competition in the telephone industry has unquestionably brought about advantages to the public that could have been secured in no other way, but competition becomes harmful when it departs from honorable methods and seeks to secure business upon any basis other than merit and good service and fair rates. It is to be hoped that the day is not distant when the telephone branch of the electrical art will be dignified by business methods similar to those which now obtain in other branches, to the permanent good of telephone securities as an investment.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Cost of Electric Equipment for Outlying Communities.

In a paper by Mr. J. S. Knowlson, of the General Electric Company, read at the Northwestern Electrical Association convention at Milwaukee, Wis., Jan. 21 and 22, it was stated that of the 670 central stations in Iowa, Minnesota, Wisconsin and the Dakotas, 39 per cent are in towns of 1200 inhabitants or less. Many of the latter are receiving excellent returns from the investments.

The author presented the following data on transmission voltage, equipment, necessary outlay and margin of safety and profit which may be expected from substations in towns of various sizes at various distances from the central station.

Population served.	Rating of substation in kw.		Distance from substation to city limits — 3 miles.	6 miles.	9 miles.	12 miles.
500	25	Total investment.	$4,800	$7,500	.....	.....
		Margin of safety and profit.....	11.5 per cent	3.7 per cent		
		Transmission	2,300-volt, three-phase	2,300-volt, three-phase		
1,000	60	Total investment.	$7,600	$10,000	$12,000	$14,200
		Margin of safety and profit.....	21 per cent	13.5 per cent	10 per cent	5.5 per cent
		Transmission	2,300-volt, three-phase	11,000-volt, three-phase	11,000-volt, three-phase	11,000-volt, three-phase
1,500	100	Total investment.	$10,000	$12,200	$14,000	$16,300
		Margin of safety and profit.....	25 per cent	18.7 per cent	13.9 per cent	10 per cent
		Transmission	2,300-volt, three-phase	11,000-volt, three-phase	11,000-volt, three-phase	11,000-volt, three-phase

The total investment includes the outlay for the transmission lines, transformers, meters, street lamps and distributing system completely installed. The estimate includes the cost of 50 poles per mile of line, at $9 per pole, with cross-arm, pins, insulators, etc., set ready to receive the wire. The power lost in transmission is assumed to be from 5 to 10 per cent. The yearly depreciation, insurance and taxes are assumed to represent 10 per cent of the total investment. The margin of safety and profit is expressed in per cent of the total investment. The gross income is estimated at $4.50 per inhabitant, the maintenance and labor cost being from 50 cents to $1 per inhabitant. The energy is assumed to cost 1.5 cents per kw-hour at the busbars, not including depreciation, insurance, etc.

The author expressed the belief that there are large possibilities for the profitable extension of electric service into outlying towns and villages, and that these possibilities merit the consideration of the small central station as well as the large.

Educational Work of the New York Edison Company.

Welfare and educational work for employees of large corporations is receiving greater attention than ever, and the winter courses of lectures and laboratory practice conducted in various cities offer excellent opportunities. The educational work of the New York Edison Company is worthy of especial notice owing to its high standard of excellence and the completeness of the courses. This work was arranged by a committee of the Association of Edison Employees.

In September a series of 12 illustrated and experimental lectures was begun by Prof. Sydney W. Ashe, entitled "From Coal Pile to Consumer." This series ended in December, and will be followed by talks given by men who are successfully designing or operating large engineering undertakings. On Wednesday evening, Jan. 20, Dr. Samuel Sheldon gave an interesting and instructive talk on the "Regulation of Electric Machinery" as a part of the latter series, in the Edison Audi-

torium, where the lectures are held. These talks will be continued on Wednesday evenings throughout the winter. A course in laboratory practice was inaugurated in November to extend over a period of 20 weeks, ending in April. Both of these courses are free to all employees of the company.

The laboratory is located in the rear portion of the company's library, at 44 West Twenty-seventh Street, on the floor below the Auditorium, and is suitably equipped with apparatus necessary to conduct the various experiments.

The laboratory will be open every Monday, Tuesday, Thursday and Friday evenings during the course. The experiments during the four evenings of each week will be similar in character in order to best accommodate the large attendance. Copies of all textbooks which may be recommended in connection with the lecture course and laboratory practice are filed in the company's library.

Tungsten Lamps in Indiana.

The experiences of several Indiana central-station men with the tungsten lamp were given in a discussion on this subject at the special meeting of the Indiana Electric Light Association at Indianapolis Jan. 26. Mr. R. M. Cass, of the Indianapolis Light & Heat Co., read a short paper on the general subject.

Mr. Cass said in regard to the complaints made by some as to the high price charged by the manufacturers for these lamps that we must consider the high development expense that the manufacturers had undergone. We must also consider the effect on the central-station industry of flooding the market with cheap lamps of such low efficiency before there is time to adjust to the new conditions. Comparing the arc with the tungsten many think that the arc will be altogether displaced by the tungsten lamp. Comparing an installation of 3-amp arcs with one of an equal number of 250-watt tungstens he figured that the tungstens would be better from the central-station standpoint if the consumer renewed the tungsten and the company had to maintain the arcs.

Comparing the 250-watt tungsten with a 4-burner gas arc under common rates he made a comparison showing that the tungsten had the best of the gas. Mr. Cass thinks the average life of the tungsten lamp in commercial installations is now over 800 hours.

Mr. S. H. Smith, of Marion, Ind., said that there was not a gas arc in the business district of Marion. They had been displaced in the past mainly by flat-rate clusters of Gem lamps and now tungsten clusters on a flat rate are being pushed. At one time the local contractors and some lamp salesmen started to reduce consumers' bills by selling tungsten lamps of the same candle-power as the carbon lamps displaced. His company therefore went after the business with a flat-rate tungsten cluster maintained by the company. The consumer, however, buys the lamps so that he will be careful not to burn the cluster when not needed. His company had over 100 installations of Gem lamp clusters in use before the tungsten lamp came in and found only two cases where the candle-power had been increased by the consumer.

Mr. P. H. Palmer, of Kokomo, thought that the tungsten lamp was most likely to affect the revenue from residences. The way to handle the situation was for the central station to control the tungsten lamp business in a town and get the higher candle-power tungsten lamps installed before people have a chance to try the lower candle-powers. Once the higher candle-power is in use, no one is willing to change to smaller lamps.

Mr. J. H. Harding, of La Porte, said that the tungsten lamp had on the whole increased his revenue. He did not favor, however, the introduction of any flat-rate scheme, as he thought it was a step backward, and that flat rates were something we have been trying to get rid of for many years.

Mr. Smith, of Marion, in defence of the flat rate, explained that consumers had to purchase lamp renewals, which, with the tungsten lamp, were high enough so that it made the consumers careful about wasting current.

Mr. T. W. McNamee, of Wabash, said that he had found the tungsten lamp an excellent weapon against gas competition. It had also been the means of shutting down one isolated plant in his town. The Tremont Hotel had a load of 15 kw in its lobby dining-room before the tungsten lamp came. His company put in tungsten lamps, using 6 kw, with efficient reflectors, and the illumination was greatly improved. The load was reduced so that the isolated plant was shut down and service taken from the central station. He had thought that a flat rate might be a good thing if used with a controller which would prevent more than a certain number of lamps being turned on at once. He had written to the manufacturer of such a controller for information as to what other central stations were doing with it, and the schemes adopted for its use, as well as the results of experience with it, but about all he could get out of them was that the controller was a good thing. He suggested starting a circuit in the downtown district, to be turned on at 6 a. m. and turned off at 10 p. m. A flat-rate equivalent to three cents per kw-hour, assuming lamps would be operated the entire time the circuit was on, would yield a gross revenue of about $150 per kilowatt connected per year.

Mr. C. C. Perry, of Indianapolis, thought that a plan of this kind would be unnecessarily expensive for the consumer, and suggested that a system of rates giving a low rate to the long-hour consumers would be better.

Mr. Hollingsworth, of Marion, said that in Muncie and Marion 35 gasoline lighting plants had been put out of business by flat-rate propositions with Gem lamps. With tungstens it would have been much easier. Whenever a plant was taken out the company agreed to use its best efforts to sell the plant for the new consumer and would advertise it for sale.

High-efficiency Lamp Renewal.

BY J. F. MUSSELMAN, JR.

The high-efficiency, metallic-filament incandescent lamp has been reduced in cost and improved in construction within the last few years till there are now on the market, to select from, two types of incandescent lamp which differ materially in construction, life, efficiency and cost of renewal. And in making a present-day installation or a renewal of incandescent lamps, the modern tungsten unit, with a consumption rate of 1¼ watts per candle-power and a life of about 1000 hours is to be balanced against a lamp of the carbon-filament type with a consumption rate of 3.1 or 3.5 watts per candle-power and a useful life of 600 or 1200 hours, respectively. To make an estimate of this kind one may assume a cost of $85 per 100 for the tungsten lamp and less than one-third as much, or about $24 per 100, for a 32-cp carbon-filament unit of a good grade.

As to the relative merits of the two types of lamps as sources of illumination, there is much to be said, and the difference in color and intensity will in some cases determine the lamp to be used; but in this article the lamps will only be compared from a standpoint of cost of energy and renewal, and the conclusions hold good only in installations where satisfactory results can be had from the use of either kind of lamp.

The accompanying table gives the cost of energy and renewal per 1000 hours of a 32-cp, 3.5-watt carbon-filament lamp; a 32-cp 3.1-watt carbon-filament lamp, and a 32-cp, 1.25-watt tungsten lamp at various cost prices of energy from $0.002 to $0.125 per kw-hour. The 32-cp unit was selected as a basis of comparison on account of its being a unit which can be had in any of the three lamps. It also is a unit small enough for use in almost any ordinary installation.

From the foregoing it will be seen that for any ordinary installation where either a carbon- or tungsten-filament lamp can be used the short-lived 3.1-watt carbon-filament lamp is never a good investment, for however cheap or however costly the electric energy may be, either a long-lived 3.5-watt carbon-filament lamp or a tungsten lamp gives a lower total cost per 1000 hours. Hence, a 3.1-watt lamp is no longer to be considered except in cases where the lamp breakage is very high or the vibration is

so great as to shorten the life of the tungsten filament, or where some other local condition makes the use of this filament unadvisable, and then only when energy costs more than 1.6 cents per kw-hour, for at any lower rate the 3.5-watt lamp is a better investment.

Where energy is bought at a meter rate the selection of the lamp to be used is a simple process, and for any ordinary installation where either type can be employed, it resolves itself into the use of 3.5-watt carbon-filament lamps where the rate is less than 1 cent per kw-hour and tungsten lamps wherever the rate is more than that. The above results are sometimes upset by the fact that some public service companies furnish carbon-filament lamps free of cost, but charge for tungsten lamp renewals; then there is a natural tendency of all users of light to use more if they think it is cheap.

The question of lamp installation or lamp renewal in cases where the energy is generated by an isolated plant reduces itself to the net cost of generating the energy; and, if the plant is already in operation and of sufficient capacity to supply lamps

	Carbon filament.		Tungsten filament.
Candle-power	32	32	32
Watts per candle-power.	3.5	3.1	1.25
Total watts	112	99.2	40
Hours total life	1,200	600	1,000
Cost of lamp	.24	.24	.85
Cost of renewal per 1,000 hours	.20	.40	.85

Cost of energy per kw-hour.	Combined cost of energy and lamp renewals per 1000 hours.		
	Carbon filament.		Tungsten filament.
.002	.424	.597	.93
.003	.536	.695	.97
.004	.648	.794	1.01
.005	.760	.892	1.05
.006	.872	.991	1.09
.007	.984	1.090	1.13
.008	1.096	1.189	1.17
.009	1.207	1.287	1.21
.010	1.32	1.39	1.25
.012	1.54	1.59	1.33
.014	1.77	1.79	1.41
.016	1.99	1.99	1.49
.018	2.22	2.19	1.57
.020	2.44	2.38	1.65
.022	2.66	2.58	1.73
.024	2.88	2.78	1.81
.026	3.11	2.98	1.89
.028	3.34	3.18	1.97
.030	3.56	3.38	2.05
.032	3.78	3.58	2.13
.034	4.01	3.78	2.21
.036	4.23	3.98	2.29
.038	4.45	4.18	2.37
.040	4.67	4.37	2.45
.042	4.90	4.57	2.53
.045	5.23	4.87	2.65
.050	5.80	5.36	2.85
.055	6.36	5.86	3.05
.060	6.92	6.35	3.25
.065	7.48	6.85	3.45
.070	8.03	7.34	3.65
.075	8.60	6.84	3.85
.080	9.16	8.33	4.05
.085	9.72	8.83	4.25
.090	10.28	9.32	4.45
.095	10.83	9.82	4.65
.10	11.40	10.32	4.85
.105	11.96	10.81	5.05
.11	12.52	11.31	5.25
.115	13.08	11.81	5.45
.12	13.64	12.30	5.65
.125	14.20	12.80	5.85

of either type, the cost to generate the additional energy necessary for the carbon-filament lamps amounts only to the cost of the additional coal, water and ash removal, as it does not entail any additional labor in the engine or boiler room, the interest on the power-plant investment and the depreciation of the plant being already provided for.

The cost of the additional energy, figured in this way, is very low, and for a small plant, where an estimate can be made on a basis of water consumption of 51 lb. per kw-hour and an evaporation of 8.5 lb. of water per pound of coal, the coal, water and ash removal amounts to about $0.0112 per kw-hour with coal at $3.50 per ton. But for the lighting load of an office, store or factory building, or of a hotel building, where there is a considerable proportion of its contents ventilated, about one-third of the heat of the coal used throughout the year is absorbed by the heating apparatus in the form of exhaust steam, and if the exhaust steam were not available, the deficiency would have to be made up by live steam. This fact reduces the above figure for the cost per kw-hour to $0.0074, and at this rate the long-lived carbon-filament lamp makes the most economical installation, saving, as will be seen from the table, about 12 cents per 1000 lamp-hours.

For a new plant, where the size of the generating equipment can be reduced by the use of the high-efficiency lamps, it is necessary to add to the above figure the interest and depreciation charges for the increased cost of the generating plant made necessary by the use of carbon-filament lamps. These charges, where lamps are used about 1000 hours per year, amount to about 18.7 cents per 1000 lamp-hours, which includes no credit for the reduced capacity of boilers, as can sometimes be made, nor the reduction which is generally possible in the amount of copper used in the feeders. This figure would indicate a loss of 6.7 cents per 1000 lamp-hours by the use of carbon-filament lamps under the above conditions.

The above represents about an average condition for isolated plants, and from these figures it is at once evident that, at the present price of tungsten and carbon-filament lamps, it is never economical to design a plant or an installation of lighting fixtures on a basis of using low-efficiency lamps, and it is only in installations where the plant and fixtures are already in place that their use can be recommended.

Some Tungsten Lamp Lessons.

By H. H. MacPherson.

When the tungsten lamp first came on the market many articles were written and many predictions were made regarding the effect which the use of these lamps would have upon the business of the central station. It seemed then as though the output of tungsten lamps would be limited for some time to come by reason of the high cost and consequent increased risk of installing the necessary equipment for making them. This fact, together with the high price and the admitted fragility of the lamps, combined to make most central-station men believe that the use of them would of necessity be gradual in its growth.

During the year just past several causes have combined to make the growth in the sale and use of tungsten lamps surpass all expectations.

In the ordinary course of events a new invention like the tungsten lamp is manufactured by but one or two factories, and by them only on a small scale until the invention is well introduced to the commercial world, which fact therefore causes the early supply to be very limited. The tungsten lamp, however, was such a wonderful improvement in nearly every way over anything of the kind in existence that a large number of new factories in addition to all of the carbon lamp factories began to manufacture them as soon as they could install the necessary equipment. The resultant increase in the number of minds devoted to the improvement of the lamp soon showed its effect in the perfecting of many inventions looking to the betterment of the life and the strength of the tungsten filament. These improvements were rapidly followed by others and by a sweeping reduction in the price of the lamps, together with many more or less valid guarantee agreements. During all of this time the public press was full of glowing tales about the efficiency of these new lamps. The public was told the wattage and candle-power of tungsten lamps and vivid comparisons were made between the cost of operation of carbon-filament lamps and tungsten lamps, showing in most cases more and better light for something like one-third the money previously paid. As soon as the lamps began to be manufactured in commercial quantities they were shipped broadcast over the country to the electrical supply men, who took them up and pushed them with energy, always using the easy selling argument, "These will give you as much light as you have now for one-third of your present cost."

In view of these extraordinary conditions there is little wonder to be expressed at the enormous number of tungsten lamps which were made and sold during the year 1908. In

many cases the central-station men were taken quite by surprise. In some cities the situation was so completely out of their control that all a person in need of a little ready money had to do was to rent a push-cart and peddle tungsten lamps from door to door. A demonstration was all that was needed, for then the lamp sold itself. The chance for a demonstration was easy to obtain on account of the great amount of curiosity which had been aroused in the public mind by the popular articles which had appeared in the public press.

This state of affairs brought matters to a head for the companies almost at once. Problems as important as this one usually require much thought and time for their proper solution, because once a public service corporation sets out to follow a definite policy there is little chance of making vital changes in it without incurring public comment. Therefore, it is imperative that such a question should be examined with great care so that whatever policy is finally adopted will fit in with the general policy of the company and so bring the entire problem to a successful solution.

Regardless of any subsequent steps which might be taken it became plainly evident that each company must control the sale of lamps used on its circuits. In order to control absolutely the sale of such lamps it would appear necessary for the company to buy tungsten lamps in large enough lots to enable it to retail them at a price low enough to eliminate competition of local dealers. With the company in absolute control of the tungsten lamp business the problem becomes much more simple because the representative can know the exact conditions which exist in his territory and he can plan accordingly. While the local dealer may succeed in selling some of the larger sizes of lamps, most of the consumers want to spend initially as little money as possible, and therefore they buy the cheapest lamp which is, of course, the smallest in wattage.

In many companies there seems to be a very strong opinion that since the tungsten lamp produces such a big saving in cost of operation and so large an increase in the amount of light obtained that, "when the public learn of these things they will insist on getting the low-wattage lamps, and there will certainly be an enormous decrease in spite of all one can do." But if "all one can do" is done, the decrease will certainly be much less than if nothing at all is done.

Several years of hard personal work has taught people in most cities that a gas range and an electric iron are two absolutely necessary things to have in a home. In that same time thousands of families have changed from the electric lamp to the incandescent gas lamp and thousands more have complained of the poor light given by the electric lamp and have threatened to change to gas. These families appreciated the convenience and all the other advantages of the electric lamp, but they knew that they should have a stronger and whiter lamp that could be placed further away, hence they adopted the incandescent gas lamp. Now that the tungsten lamp has arrived the proper electric lamp is in the hands of the electric companies to take advantage of the situation.

In the business territories electricity has been superseded by gas in hundreds of places because the business men wanted more light for less money. Even in the smaller cities the business men have been educated to believe that the proper amount of light is comparable to a good location in business-bringing ability. Thousands of merchants who have been barred from the lavish use of light for display purposes on account of cost are now placed in a position where they can use it to advantage.

It is interesting to note how the changed condition of affairs has been handled thus far by the central stations of this country. Three distinct lines of progress have been followed in working out tungsten lamp policies. The method most generally used has been to follow the path of least resistance and to allow the electrical contractors and supply men to introduce the lamps as they saw fit. When it was found that the lamps were making inroads upon the lighting revenue, the company simply took over the control of the tungsten lamp business in the city by selling lamps on terms which the small dealer could not equal.

In several large cities, of which Boston is probably the best example, the tungsten lamp has been used as a medium of uniting the interests of the architects, the electrical contractors, and the electric company by advising customers how to use electricity most efficiently. By assuming that one satisfied consumer will eventually make five new ones, the company expects to offset the decrease in gross revenue brought about by the recommendations for greater economy in the use of electricity.

The third plan is best represented by the method used by the Brooklyn Edison Company. By handling tungsten lamps in large lots, co-operating with the electrical contractors and showing them how to further their own best interests by recommending a higher standard of illumination, this company is solving the "contractor" problem and is putting itself into high public favor.

In the small and medium-sized companies the system of controlling the local sale of tungsten lamps by selling them at or near cost, either with or without a renewal arrangement, has worked well, particularly when backed up by intelligent, systematic work on the part of the company's new business department. Each representative must make himself more or less of an illuminating engineer, and investigate old or inefficient installations, seeking thereby to improve the lighting and keep up the revenue. The services of a trained illuminating engineer have been found to be invaluable in such work. Such a set of conditions means that a much larger proportion of the representative's time than ever before is taken up with adapting himself to new conditions, and in holding business.

While certain classes of lighting have shown a slight decrease temporarily, the close of 1908 saw many similar classes with the largest increase in years. The tungsten lamp brought its problems, but it has not brought the expected decreases. The central-station man should take heart and say, "I have been looking for something like the tungsten lamp for years, and am glad now that it is here."

A Study in Central-Station Finances and Operation from Marquette, Mich.

The municipally owned electric light and power plant at Marquette, Mich., offers an instructive study in central-station finances. It is one of the few municipally owned electric light and power plants of the country that has been sufficiently separated from cheap municipal politics for a term of years to be operated on a business basis in much the same way as a progressive private enterprise. The plant, in accordance with the laws of Michigan, is under the control of a commission of five members.

In considering the financial results of the Marquette plant, which are noted later, it must be remembered that the city is fortunate in having nearby a water power which has been developed at a low cost per kilowatt. This has kept both the investment and operating expenses low.

The commission issues yearly a report which contains much information on the technical and financial management of the plant. In fact, much more complete information is thus available about the plant than is usually available about a plant of its size.

Some of the general central-station facts and factors applying to the plant for the year ending March 10, 1908, are given in Table I.

The first notable item of Table I is the low investment per kilowatt, which is only $82. In central stations of this size this item is seldom less than $150 and often runs up to $350. The low figure is attributable to the fact that by good management and by virtue of the low cost of operation by water power a large amount of construction work has been paid for out of the earnings and some of the original bonds have been retired. The bonds outstanding amount to $63,500. This amount plus $6,000 borrowed from the general fund of the city represents the total indebtedness or permanent investment for which the plant is liable. Bonds to the amount of $31,500 have been paid off.

The books show that $198,962.22 has been invested in the plant since the beginning of operations, in July, 1889. The amount not paid for by bond issues was paid out of the net earnings.

The gross yearly income is derived from a large number of consumers, as is shown by the small income per consumer. The motor load forms an important part of the business, as shown directly by the kilowatts connected and indirectly by the earnings per kw-equipment. This fact is also indicated by the yearly load factor which is higher than in any plant where there is not a considerable motor load.

TABLE I.

A.—GENERAL INFORMATION.

Population of district served	10,000
Rating of station, kilowatt	850

B.—UTILIZATION OF INVESTMENT AND APPARATUS.

Total investment (indebtedness) per kilowatt of station equipment.	82.00
Gross yearly income per kilowatt of station equipment	$65.00
Gross yearly income per $100 invested	$79.00
Yearly operating expenses per kilowatt of equipment, excluding interest and depreciation	$26.50
Per cent of gross yearly income spent for operation	39
Yearly operating expenses per $100 invested	$32.00
Average income per consumer	$37.00
Total connected load in kw per kw of station equipment	2.6
Connected kw load in lamps per kw of station equipment	1.44
Connected kw load in motors per kw of station equipment	0.84
Connected kw load in heating apparatus per kw of station equipment	0.32
Kw-hours sold or accounted for per 100 kw-hours generated	74.6
Yearly load factor (average load divided by maximum)	0.30

C.—DEVELOPMENT OF TERRITORY SERVED.

Gross yearly income per capita of population	$5.51
Investment per capita	$6.95
Watts of station equipment per capita of population	85
Number of customers per 100 of population	14.8
Residence customers per 100 of population	10.4

The gross yearly income per capita is as large as in some progressive private plants, thus indicating that the field has been well worked. Another thing showing the extent to which the plant is serving the community is the high number of consumers per 100 of population.

The number of kw-hours sold during the year, including the amount registered on the store room and plant-lighting meters, was 1,602,715. The relative percentages of energy sold or used for different purposes was as shown in Table II:

TABLE II.

	Per cent.
Registered on street lighting meters	14.6
" " store-room, testing and power-house meters	1.7
" " city meters for building lighting, etc	2.3
" " residence lighting meters	16.6
" " business lighting meters	37.4
" " industrial meters	27.4

The output sold for various commercial purposes for the year is shown in Table III.

TABLE III.

	City lamps and motors.	Residence lighting.	Business lighting.	Commercial motors.
March, 1907	2,550	16,627	43,447	34,147
April, 1907	2,450	16,449	38,369	43,996
May, 1907	3,660	13,940	41,114	32,497
June, 1907	1,413	13,110	35,933	29,054
July, 1907	1,642	13,730	41,547	45,142
August, 1907	1,459	15,117	42,789	47,432
September, 1907	2,616	21,384	50,454	42,054
October, 1907	2,697	25,563	63,182	34,361
November, 1907	3,475	29,352	66,433	28,970
December, 1907	3,972	30,126	70,316	31,757
January, 1908	3,356	32,123	56,848	29,999
February, 1908	2,681	27,844	45,126	37,998
	31,971	255,365	595,558	437,405

The commission does electric wiring and construction and the receipts from this source amounted to $33,316.87 for the year. This amount was not included in the gross receipts from operation, upon which the figures in Table I were based. The receipts from operation were $55,107.19.

The following figures show the relative number of consumers of the various classes:

INSTALLATIONS IN USE.

Number of residences lighted	1,040
Number of business places lighted	375
Number motors installed	70
Electric flatirons	540
Number alternating-current multiple arc lamps in service	167
Number Nernst lamps in service	89
Estimated equivalents in 16-cp lamps of all installations	41,311

The city pays the light and power commission a certain sum per year for each street lamp just as if it were a private company. It also purchases energy for lighting its buildings on the same basis as does any citizen. The rate on the 7.5-amp series enclosed arc lamps used for street lighting is $75 each. The other rates are: Residences, 7 cents per kw-hour; business places, 5 cents per kw-hour for ordinary users; long burners and large installations, 2 cents to 3 cents per kw-hour; motors, ¼ cent to 5 cents per kw-hour.

The plant at present contains one 500-kw and one 300-kw, two-phase alternators generating at 2300 volts. The past year a 6600-volt transmission, with step-up and step-down transformers, has been substituted for the 2300-volt lines formerly used between the plant and the center of the city. The water-power plant consists of a timber crib dam filled with stone, 220 ft. long, 48 ft. high, connected to the power house by a flume 6 ft. inside diameter, 2700 ft. long. The power plant has one pair of 25-in. horizontal New American turbines, working under an 85-ft. head, directly connected on one end to a 550-kw alternating-current generator and on the other end to a rope drive, to main line shaft, to which is directly connected a 300-kw alternating-current generator.

The plant has undergone the evolution and enlargement customary with similar properties and considerable loss and displacement has been paid for out of operating expenses.

The following are the disbursements for plant construction from the beginning of operation in July, 1889, to March, 1908:

For real property (water power and flowage)	$14,984.68
Power house	4,865.35
No. 1 dam and flume (original plant)	5,242.27
Dwellings (No. 1, $500; No. 2, $1,561.17; No. 3, $360)	2,421.17
No. 2 dam (new plant)	11,171.70
No. 2 flume foundation	6,957.84
No. 2 flume, wooden portion, 700 ft.	3,409.86
No. 2 flume, steel part and cover, 2022 ft.	17,127.84
Water wheels (No. 1, $2,654.96; No. 2, $2,963.65)	5,618.61
Machinery foundations (in power house)	2,455.47
Transmission (water wheels to dynamos)	2,716.69
Alternating-current generators (300-kw and 500-kw)	14,262.72
Pole lines (poles and fixtures in place)	9,255.87
Arc circuits, copper in place (22,836 lb. bare copper)	8,350.54
Arc circuits, station apparatus, lamps and fixtures	5,862.66
Commercial circuits, copper in place (118,157 lb. bare copper)	37,148.59
Commercial circuits, multiple arc and Nernst lamps	6,206.58
Commercial circuits, transformers and fixtures	19,687.59
Commercial circuits, meters	17,868.10
Commercial circuits, motors	659.70
General sundries	2,688.39
	$198,962.22

Of the foregoing, the following items of loss and displacement have been taken out of property account and entered as operating expenses:

1900.	Losses on dam	$7,549.30
1903.	One 750-lamp and one 1500-lamp alternator	8,892.91
1905.	Direct-current dynamos	5,032.33
1905.	Transmission machinery	2,752.38
1906.	Direct-current street arc lamps	4,535.66
1907.	One horse	150.00
		$28,912.58

The commission in its report estimates depreciation on the following basis:

Amounts invested.		Rate.
$14,984.68	Land	None
7,286.52	Buildings	5 per cent
54,983.59	Power plant	5 per cent
9,255.87	Poles and pole fixtures	8 per cent
2,716.69	Transmission	2 per cent
2,688.39	Team, wagon, etc	10 per cent
14,262.72	Generators	10 per cent
45,499.13	Copper conductors	3 per cent
12,069.24	Lamps	10 per cent
19,687.59	Transformers	10 per cent
17,868.10	Meters	10 per cent
659.70	Motors	10 per cent
$198,962.22		

In looking for the causes of the success of the Marquette plant and the reasons it has not drifted into the usual rut of municipal plants—in which the lack of a continuous business-like policy is likely to be plainfully evident—the first thing to be noted is the unusual personal interest taken in the plant by competent men. The chairman of the commission, Mr. J. E. Sherman, a business man used to handling large affairs, has been on the commission for years and has given to the management of the plant an amount of personal attention which is unusual among those who are burdened with public affairs in addition to important private interests. In the public spirit and pride in the enterprise which Mr. Sherman has displayed is to be found

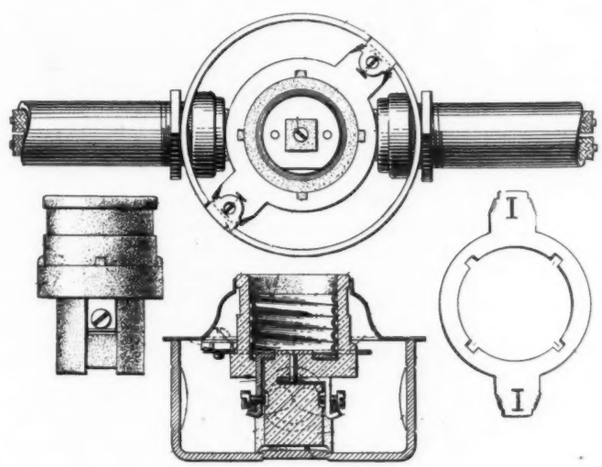
the first factor of success in the Marquette plant. Thus the plant has been for years practically under the guidance of one man acquainted by experience with its needs and interested in its success rather than under a constantly changing administration of men who have the business to learn.

The business-like management of the commission caused the employment of a competent superintendent in the person of Mr. Charles Retallic, who has been held responsible for the management of the plant just as if he were in the employ of a private company.

INTERIOR WIRING AND ILLUMINATION

Outlet Box and Receptacle for Conduit Work.

As is well known in rigid conduit work, outlet boxes must be provided for any lamps, switches, etc., connected in the system. Such a box usually comprises a cup stamped of sheet metal with openings at the side to receive the conduit sections, and a cover with a central perforation through which the lamp receptacle projects. The boxes are about 4 in. in diameter and the lamp receptacle must be anchored in place within the outlet box, usually by a fastening between the bottom or back plate of the outlet box and the receptacle, or between the cover plate and the lamp receptacle. The latter arrangement offers some difficulties in soldering, taping or compounding the wires unless the wireman leaves a long loop, because the flaring edges of the cover plate are in the way. It is also impossible to remove the cover without wholly disturbing the receptacle and the wiring. Where the receptacle is fastened by machine screws to the bottom plate of the outlet box, the holes must be registered with those of different types of receptacles and the surplus holes are apt to admit moisture. It is also necessary to have a porcelain or insulating wall between the threaded shell and the edges of the central opening through the cover, and a mere bushing ring is not satisfactory on account of its liability of becoming broken or removed and lost. The lamp receptacle usually employed has a central block which is secured to the bottom plate of the outlet box, and a projecting porcelain housing which is slipped over the central block after the connections have been made. This outer housing has a portion surrounding the threaded shell and high enough to form a partition between the threaded shell and the surrounding edge of the opening in the cover. With this arrangement and with the wiring required, it is usually necessary to have a box 4 in. in diameter and the wires are necessarily crowded against the iron back plate. To obviate the disadvantages enumerated and to provide a lamp receptacle or rosette exclusively for use in conduit wiring, Mr. James Stewart has patented the receptacle shown herewith. This has an insulating partition between the threaded shell and the edge of the opening in the cover plate which supports the wires at some distance away from the bottom plate. Means are also provided for anchoring the receptacle in place in the outlet box. The receptacle has a shoulder on which is a plurality of teats which engage with certain recesses in the holding plate. Below the shoulder is an elongated portion slightly greater in diameter than the knock-out portions of the outlet box, and the flat end face is recessed slightly so as just to fit snugly over the embossed portion of the bottom plate. The shoulder is on a line with the lugs of the outlet box. In use, a slight loop of wire is left at each box to give wire enough for the connections with the lamp receptacle or rosette. The wires are stripped and fastened to the terminals, the receptacle body being unfastened at the time. The terminal connections are made at least ½ in. away from the base of the outlet box and the cover can be removed whenever desirable without disturbing the receptacle or wiring. The receptacle is fastened against any independent movement in the box.



OUTLET BOX AND RECEPTACLE.

Illuminating Engineering vs. Common Sense.

BY ALBERT J. MARSHALL.

Inasmuch as I am one of the "guilty" persons who have dared, by study, observation and experimental work, to endeavor to acquire knowledge of how to use artificial light in a more practical manner than has heretofore been the custom, and therefore have incidentally assumed the title of illuminating engineer, I feel that I am at liberty to endeavor to answer an article appearing in the issue of Jan. 21, entitled "Illuminating Engineering vs. Common Sense."

The article asks, "Suppose the illuminating engineer, previously so called, had not appeared on the scene, would we not have had the tungsten lamp, flaming-arc lamp and inverted gas burner just the same?" Perhaps we would. In all probability gold and diamonds would have been, and are oftentimes, discovered without the assistance of trained mining experts, but the mere finding of such metal and gems in the rough is one thing, while developing them so they will assume esthetic shapes and also serve utilitarian purposes, is another. Likewise with light. While there are concerns which manufacture lances, etc., for doctors to use for medical purposes, yet it is questionable if such concerns are qualified to use that which they produce. It should be understood that the illuminating engineer, while doing some experimental and research work with a view to developing illuminants, is more interested in the equipment and application of illuminating units than in their creation.

It is also asked, "Would the illuminating engineers be willing to wager their professional standing (much thanks for such recognition) on the ability of the people to pick out the installations that they have designed from those that have been laid out by the architect or electrical engineer?" There is, to my mind, but one answer to this question, and that is, yes. It is easily possible for a person of ordinary intelligence to form such judgment, for the very simple reason that it is an easy matter to see almost at a glance whether a lighting system has been designed by some one who understands its necessary requirements or by someone who thinks he does, or by someone who does not think at all. There are architects, electrical engineers and others who have a very good idea of what the practice of illuminating engineering principles consists, and while their work is perhaps not absolutely perfect, yet it is far in advance of installations designed by people who ridicule the idea of the intelligent use of artificial light, which, when all is said and done, is illuminating engineering.

There are "illuminating engineers and illuminating engineers" just as there are "M.D.'s and M.D.'s," and "architects and architects," and "salesmen and salesmen." The mere fact that

there are so many so-called illuminating engineers shows in itself that a number of people at least appreciate the value of such work, even though they are not finished in the arts and sciences necessary to carry it to a successful conclusion.

An illuminating engineer, to my mind, should be qualified to handle any and all problems pertaining to his work that may be submitted to him, and must, among other things, appreciate the following necessary points: First, the giving of due consideration to the physiological and hygienic sides. Second, the esthetic, in a manner calculated to produce harmony. Third, the technical and theoretical, which exists chiefly in the laboratory. Fourth, but by no means least, practical knowledge—that knowledge which is gained by experience, such being the results of systematically directed efforts.

It is stated further that "there are, undoubtedly, a large number of specialists to-day who are entitled to take the professional degree for illuminating engineering, although in many instances they would be the last to assume it." A question in this connection is: What constitutes an illuminating engineering degree? To the statement that there are a large number of such specialists to-day, exception can easily be taken. The men in this country and abroad who have the necessary qualifications of an illuminating engineer to carry out intelligently his work are, to my mind, few. The Illuminating Engineering Society, organized in January, 1906, and having a membership of approximately 1000, has among its members representative oculists, physicists, mathematicians, artists, gas engineers, electrical engineers, civil engineers, decorators, designers, architects, oil and acetylene experts, etc.—in fact, men drawn from all professions, sciences and arts having to do with the use of artificial light or effects.

Back-yard Service Connections.

In the suburban sections of cities it becomes quite a problem to connect up various dwellings with the electric light company's mains without excessive expense or without marring the attractiveness of the streets by pole lines. Some few cities have alleys back of the houses so that the pole lines can be run along these, and the street itself kept free from any encumbrance. The majority of cities, however, have no alleys, so that either an underground conduit system is installed or a pole line is erected to carry the mains. Shade trees, however, are among the attractions of the suburbs, adding not a little to the beauty of the surroundings and incidentally adding to the worry of the electric light company. Besides, overhead wires are not particularly in

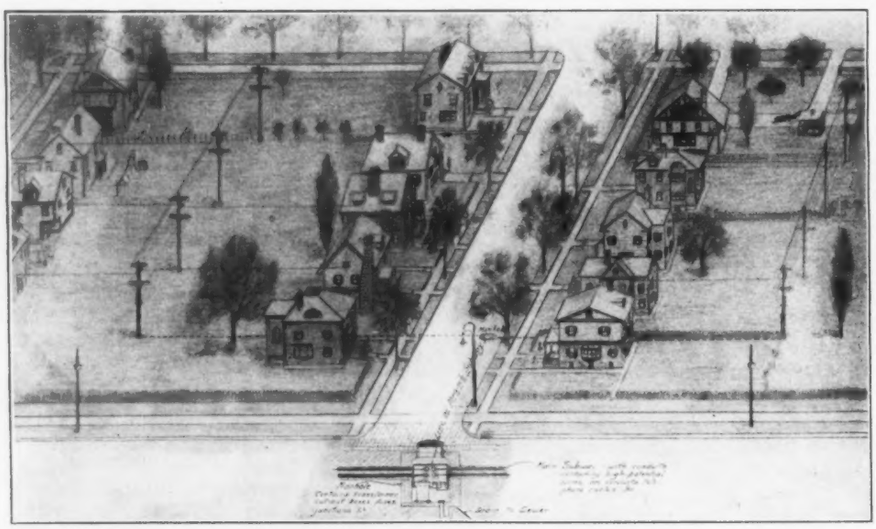


FIG. 1.—PLAN OF BACK-YARD POLE LINES AS ADOPTED IN ROCHESTER, N. Y.

public favor in such districts. In Rochester, N. Y., the electric light company has whipped the devil around the stump by erecting a pole line on the back-yard boundary line. The scheme is well illustrated in Fig. 1, and Figs. 2 and 3 show, respectively, a street and back yard on which the scheme has been carried out.

FIG. 2.—STREET ON WHICH HOUSES ARE CONNECTED TO BACK-YARD POLE LINE.

There are two telephone companies in Rochester and these cooperate with the Rochester Railway & Light Company in maintaining these combination pole lines. The company has deeded to it by the owner the ground on which the pole is erected, together with the right of free access at all times, and it in turn places on the streets the improved type of arc lamp post shown in Fig. 2.

FIG. 3.—LIGHT AND TELEPHONE WIRES ON BACK-YARD POLE LINE.

In running the mains to these back-yard pole lines, high-potential lines are run underground to a transformer in the manhole nearest the desired street. From here low-potential circuits run to a manhole in the street opposite the pole lines, whence they branch and run underground to the end pole on either side. The mains are then brought up through conduit to the cross-arm. The electric-light mains are carried on the top of the pole and the telephone circuits lower down. Service connections are connected to the mains and brought in overhead to the rear of the house, thus leaving the front of the house free from unsightly wires and service connections. The pole line extends from block to block, depending on the number of houses connected. No difficulty has been encountered thus far in

securing the free grant of the ground upon which the poles rest and the right of access. The property owners appreciate the value of keeping the streets free from poles and the shade trees from being killed or otherwise marred, owing to the presence of electric light or telephone wires. So far as appearances go, the plan possesses all the advantages of a conduit system and the cost of reaching suburban homes with electricity in a section where underground connections in the streets would be insisted on, is not much greater than would be entailed by a straight overhead system. Moreover, the scheme has met with public approval, at least in Rochester, and is applicable to many other cities where detached houses abound.

New Telephone Patents.

SWITCHBOARD CIRCUIT SYSTEM.

Mr. H. G. Webster has obtained four patents for various improvements and features of two-wire common-battery systems. One of these patents describes a special method of applying the heat coil protection to subscriber lines. Heretofore it has been customary to include the heat coil directly in the line circuit, but Mr. Webster has so arranged his circuits that his heat coil is included in a branch of the circuit leading to the relays only, and he is, therefore, enabled to use a high resistance heat coil without affecting the transmission. When the heat coil operates in response to sneak currents, the main line circuit is opened, the operating springs being associated in the main line circuit and the winding of the coil only being in the branch circuit.

The remainder of Mr. Webster's circuits refer to special methods of connecting the line, cut-off and supervisory relays. In one of the systems the supervisory relay is made two-stage, the first action lighting the supervisory lamp and the second step of the action, under an increased current, sufficing again to open the lamp circuit. The cut-off relay is bridged across the line, and, when it alone is in circuit, the supervisory relay is in the intermediate position. When the subscriber's set is bridged across the line in parallel with the relay, however, there is sufficient current flow to cause the complete operation of the supervisory relay.

In one of the remaining patents granted to Mr. Webster the circuits are so arranged that the line and cut-off relays are in series when the bridge is formed across the line, this giving a higher resistance to the bridge without increasing the sensitiveness of the cut-off relay, and in the other a single relay suffices for both line and cut-off purposes. When the subscriber is calling, one of the windings, acting alone, serves to light the line lamp. After the operator has inserted her plug, however, the second winding comes into action and balances the first winding, causing the extinguishing of the line lamp. All of the patents have been assigned to Mr. M. G. Kellogg.

Mr. A. H. Dyson, of Chicago, has also patented a circuit system for two-wire, common-battery switchboards. In his system the novelty lies in so associating line and cut-off relays that, in order for the cut-off relay to operate upon the insertion of the plug in response to the operator, the line relay must have previously operated.

Mr. C. S. Winston, of Chicago, has invented a three-wire common-battery switchboard circuit system, the arrangement of line and cut-off relay of which is almost the same as usually employed with these systems, the only change being that the cut-off relay, responding to current from the sleeve wire, cuts off only the ground side of the line relay and the line lamp circuit. The uncut line relay coil serves as a retardation coil battery-feed wire, the return ground side being through the ring side of the cord circuit and through the supervisory relay.

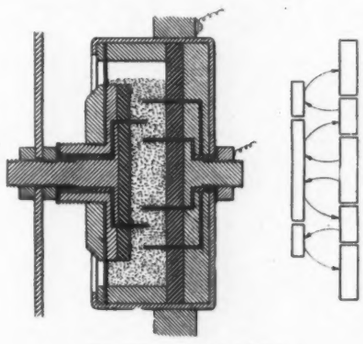
Mr. W. W. Dean has patented an improvement in his busy-test system for two-wire circuits of the Dunbar type. Heretofore he has isolated the common parts of his busy-test system from the various individual cord pairs by means of auxiliary contacts in the listening key. In the present arrangement the auxiliary contacts are associated with one of the supervisory relays of the answering cord of the pair in question. This relay is always operated at the time a busy test is desired and, therefore, the busy-test circuit is connected to the cord pair which is to be used in testing. The busy test becomes cut off as heretofore by one of the contacts of the supervisory relays associated with the calling cord just as soon as this calling cord is inserted in the jack.

PHONOGRAPH ATTACHMENT.

A patent for a phonograph attachment to telephones has been granted to G. J. Boelen, of The Hague, Netherlands. This consists of a phonograph with reproducer so associated with the telephone station that it may, through the connection of its control relays with the telephone line, be caused to repeat in the telephone line any desired message, after which it resets itself awaiting the next call.

NEW TELEPHONE INSTRUMENTS.

A multiple electrode transmitter forms the subject of a patent granted to C. D. Enochs, of La Crosse, Wis., which is illustrated in section in the accompanying diagram, which shows the course of the current back and forth through the transmitter in its



ENOCHS TRANSMITTER.

course from one terminal electrode to the other. The figures are so plain that little description is necessary. It may be well, however, to call attention to the fact that the transmitter button assembled is of a size just about equal to that usually employed for such instruments.

TELEPHONE HOOD.

A telephone hood to serve in lieu of the familiar telephone booth in special cases has been patented by H. L. Burrhus, of Hornell, N. Y. The telephone equipment is placed within the hood, which swings about a horizontal axis. In the unused condition the hood is tilted up to the vertical position, a device attached to it having performed the usual hook-switch function. During use one draws the hood down over his head and shoulders, until the transmitter is in front of his mouth. In this position the circuits are arranged for talking.

IMPROVEMENT IN AUTOMATIC-SYSTEM STATION DIALS.

In automatic-exchange systems it is absolutely necessary for satisfactory results that all parts designed to work in synchronism do so. If, therefore, any part be forced to a higher speed of operation than that for which it is designed, it is readily seen that the working of the whole system may be defeated. In actual practice it has been found that at times subscribers will attempt to force the sending dial in its return movement, with the result that all parts become forced out of step or otherwise wrongly affected. To overcome this difficulty John Erickson, of Chicago, has invented a sending dial which cannot be forced. He has developed this in two styles, both of which are covered by patents.

In one of these the finger-stop, which is movable, carries a lever, integral with it, which has a pin lock engaging appertures in the inner disks of the mechanism. In pulling up a digit, as the finger strikes the stop, the latter moves against its back stop, thereby locking the whole mechanism until such time as the finger-dial is released. In the other form the control is by means of an internal ratchet-and-dog device. Any attempt to

force the finger-dial backward throws the dog into a locking engagement, so that the whole device becomes locked until after the backward pressure upon the finger-dial is removed.

Letters to the Editors.

The Humming Telephone.

To the Editors of Electrical World:

Sirs:—I read with some interest the brief notice having the above caption on page 260 of your issue of Jan. 28, and referring to a paper in the *Proceedings* of the American Philosophical Society for 1908 by Dr. A. E. Kennelly and Mr. Walter L. Upson, entitled "The Humming Telephone; A Contribution to the Theoretical and Practical Analysis of Its Behavior."

I note that it is said that the fact that the telephone receiver held either in contact with or close to the face of the transmitter may cause the production of a hum or singing tone appears to have been observed by Mr. A. S. Hibbard, and first published in a paper read in 1901 by Mr. F. Gill before a meeting of the Dublin section of the (British) Institution of Electrical Engineers.

It is, however, true that the same thing, or, at any rate, something which is very nearly the same thing, was noticed by Professor D. E. Hughes in his original microphone experiments of 1878. In a paper read by Professor Hughes before the Physical Society, London, June 8, 1878, and subsequently published in the July, 1878, number of the *Philosophical Magazine*, pp. 44-50, the author remarks: "I have recently made the following curious observation: A microphone on a resonant board is placed in a battery circuit, together with two telephones. When one of these is placed on the resonant board, a continuous sound will emanate from the other. The sound is started by the vibration which is imparted to the board when the telephone is placed on it; this impulse, passing through the microphone, sets both telephone-disks in motion, and the instrument on the board, reacting through the microphone, causes a continuous sound to be produced, which is permanent so long as the independent current of electricity is maintained through the microphone."

As before stated, this is either the same operation, or something so near it, that an experimenter having discovered one may without further discovery accomplish the other.

Boston, Mass. Thomas D. Lockwood.

Association of Industrial Plant Electrical Engineers.

To the Editors of Electrical World:

Sirs:—So far as I have been able to learn, there is no association or society composed of those having charge of the electrical and mechanical equipment of industrial plants, excepting, of course, the Association of Electrical Engineers of Steel Plants.

The requirements and conditions to be met in the operation of industrial plants are entirely different from any other class of equipment and there certainly should be opportunity for inestimable benefit to the manufacturer, the commercial concerns, but especially to the electrical engineers and those having charge of the operating end, from an organization of this type. Of course, there would be the necessity of preventing a society of this nature from becoming used as an advertising medium by electrical jobbing concerns, and the membership would necessarily be restricted to the chief engineers, electrical engineers and others connected with industrial plants only. It occurs that this thought may also have come to others and I should be glad to have an expression of opinion from anyone interested in the matter of such a society or association.

Providence, R. I. C. E. Fairbanks,
Chief Engineer, Gorham Manufacturing Company.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Improvement of Power Factor.—M. Walker.—A paper read before the Manchester section of the (Brit.) Inst. Elec. Eng. The author discusses the improvement of power factor by (1) using synchronous motors, (2) using capacity, and (3) improving the induction motor. In regard to the last-mentioned method he first describes Leblanc's system of special exciters

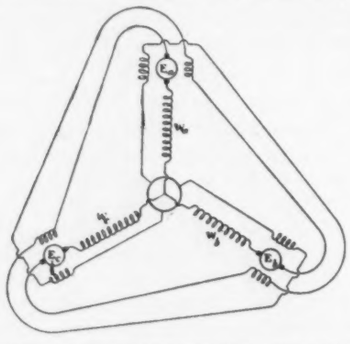


FIG. 1.—EXCITERS IN CIRCUIT WITH THREE-PHASE ROTORS.

and Heyland's arrangement, and then describes a new type of machine, termed a "phase-advancer," which acts like the exciters proposed by Mr. Leblanc. The reason that the induction motor calls for so large a wattless current is that its magnetizing current is supplied at a high frequency. Where, however, the magnetizing current is supplied in the rotor at the low frequency of the rotor circuit, the value of the wattless volt-amperes required is reduced to 2 per cent or 3 per cent of that required at the frequency of supply. In 1895 M. Leblanc proposed to supply the magnetizing current to the rotors of induction motors and generators by means of special exciters, which consisted of commutating alternating-current generators whose magnets were excited by the rotor currents. If Leblanc's exciters be applied to a three-phase rotor, three exciters would be necessary, and these might be connected in circuit as illustrated in Fig. 1, E_a, E_b, E_c, being the armatures of the exciters—made like single-phase motors and provided with compensated windings—and W_a, W_b, W_c the phase windings of the rotor; or the arrangement might be with phase C reversed—the slip being increased—or with phase A excited from phase B reversed—the slip being decreased. The author's phase-advancer is similar in principle to the exciter proposed by Leblanc. Fig. 2 gives the diagrammatic representation of a "phase-advancer." When wound for three phases the field magnet has three poles—larger machines may have any multiple of three. The armature core resembles an ordinary direct-current armature core, and the coils are like the coils of an ordinary railway motor, except that they have in the case illustrated in Fig. 2 a span of 120 deg. instead of 90 deg. One end of each coil, which will be called the inner end, is connected to a star-point. Each outer end is connected to one bar of the commutator. The armature in this way resembles in principle Elihu Thomson's arc-lighting generator, except that in this case there are a greater number of coils. On the commutator are three brushes, which bear upon the segments, connected to coils which are for the time being passing under a pole. Each pole is provided with a compensating winding placed in slots in the pole-

face, the winding being arranged so that the ampere-turns per inch along the pole-face are equal, or slightly greater than the ampere-turns per inch of periphery of the armature. Following the armature circuits, commencing from the star-point along coil 1, 2, it passes under the pole *pC*, then under pole *pB*, and it makes as many turns in front of the poles *pC* and *pB* as are necessary to generate the required voltage. It then passes to

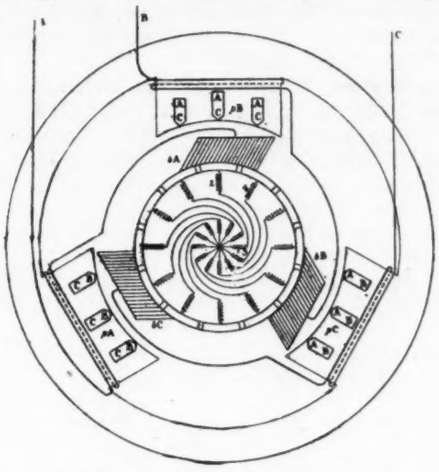


FIG. 2.—EXCITER OR "PHASE-ADVANCER."

brush *bA* and on to the series exciting coil on pole *pA*, then it passes to the compensating windings marked *A* in the slots in poles *pC* and *pB*, and from these to phase *A* of the rotor of the induction motor. The currents in the other phases pass through similar circuits, and it will be seen that the e.m.f. generated in any phase is due to a field which is produced by the current in the other two phases. By the use of an exciter in the rotor circuit it will be possible to increase greatly the output of a motor frame. But a much greater gain in output can be secured by deepening the slots of both the stator and the rotor and putting in larger conductors. At present the depth of the slots is limited because it is desirable to keep down the leakage flux and the length of saturated teeth. The limitation of an induction motor frame will then be by considerations similar to those which now obtain with synchronous motors. There is yet another use for an exciter in circuit with the rotor of an induction motor. If the e.m.f. of the exciter has a considerable component opposed to the e.m.f. generated in the rotor winding the slip is increased. The exciter, therefore, can be utilized to change the speed of an induction motor. The exciter, when its e.m.f. is opposed to the rotor e.m.f., runs as a motor and is capable of putting back into the system the power represented by the slip of the induction motor, which would otherwise be wasted in resistance. Fig. 3 shows diagrammatically a method of exciting a two-phase rotor of an induction turbo-generator by means of a "phase-advancer." The rotor and "phase-advancer" are mounted on the same shaft. *wA*

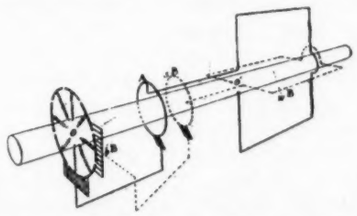


FIG. 3.—PHASE-ADVANCER DIRECT CONNECTED TO TWO-PHASE ROTOR.

and *wB* show diagrammatically the two-phase winding of the rotor. One end of each phase is connected to the shaft at *O'*. The other ends are connected to the slip rings *sA* and *sB*, and from these rings the current is collected by means of brushes and carried to the brushes of the "phase-advancer" *bA* and *bB*, which in this case would be provided with four poles, not shown in the diagram. The inner ends of all the armature coils are connected to the shaft at the point *O*, and the operation of the exciter is exactly the same as in the case described in Fig. 2, except that two phases are employed instead of three. It will, however, be seen that the brush capacity of the whole set is exactly the same as might be employed with ordinary direct-current excitation—in fact, no one looking at such a set would be able to say whether the excitation was by direct or by alternating current. If at any time it became necessary to run the machine as a synchronous set, all that would be necessary would be to excite the field magnets by means of coils connected as a shunt.—Slightly abstracted in Lond. *Elec.*, Jan. 22; the complete paper in Lond. *Elec. Engineer*, Jan. 22.—In the discussion which followed the reading of the paper, Mr. F. C. Raphael said that he feared there would be some difficulty in inducing consumers to adopt any device which increased the cost of their motors, and which also interfered with the extreme simplicity of the induction motor by a lding a commutator arrangement. The consumer at present paid by the energy he consumed, consequently he did not concern himself with the power factor of the motors. He thought, therefore, that attention should be directed to improving the power factor at the station end. Several speakers remarked that they could not see any difficulty in charging an increased rate for consumers using motors with low power factors.—Lond. *Elec. Eng'ing*, Jan. 21.

Short-Circuits on Alternators.—E. J. BERG.—Short-circuits on alternators are serious only at low frequencies and especially with low-frequency turbo-generators. The author analyzes the electrical interactions in an alternator under short-circuit. To overcome the effects of the enormous stresses which occur during the first few fractions of a second of a short-circuit, it would seem theoretically necessary only to build the generator with high resistance or self-induction. But this is practically very difficult without increasing at the same time the armature reaction. A practicable remedy is the use of external reactance in connection with turbo-generators as built at present. The reactors are placed in the generator leads as near to the machine as possible so as to eliminate the likelihood of a short-circuit taking place between them and the generator, or they are placed at the junction of the three windings in star-connected generators. In the first case, in addition to serving as a protection against mechanical strains, they save the generator winding, to a certain extent, from high-frequency surges from the outside; they also limit the current which would flow from other machines on the same busbar in case of a short-circuit in the generator winding. In the second case they do not offer these last two advantages, but they protect the generator from its own current if the short-circuit takes place in the winding proper.—*Gen. Elec. Rev.*, February.

Transformers for Electrochemical Work.—M. H. YAZIDJIAM.—An illustrated description of large transformers built by the Oerlikon Company for electrochemical purposes. The type described is a single-phase core transformer of 4450-kva rating, for a frequency of 25 cycles. The e.m.f. is reduced from 15,000 to between 115 volts and 155 volts, while the current is raised from 302 amp to 28,200 amp. The construction of the transformers is described and their characteristic curves are given, showing losses, voltage drop, short-circuit curve and efficiency.—*Elek. u. Masch.* (Vienna), Jan. 17; *Elek. Zeit.*, Jan. 21; the first part of the article also in *La Lumière Elec.*, Jan. 16.

Predetermination of Electric Machines.—R. V. PICOU.—The conclusion of his paper on the mathematical calculation of dynamo-electric machinery. The author sums up the fundamental formulas for use in such calculations and applies them to the design of a 1300-kva, three-phase turbo-alternator, for 140 amp and 4500 volts and a frequency of 50 cycles.—*La Lumière Elec.*, Jan. 16.

Brushes.—C. RICHTER.—A paper discussing the problems of theoretical mechanics involved in the sliding of brushes on the commutator and the conditions of equilibrium.—*Elek. u. Masch.*, Jan. 10 and 17.

Heating of Electrical Machinery.—G. BENISCHKE.—A mathematical article discussing the heating and cooling of electrical

machines on the basis of an exponential formula. On the basis of such considerations it is possible to determine the final temperature by making tests which are not extended until the final temperature is reached.—*Elek. u. Masch.* (Vienna), Jan. 10.

Lamps and Lighting.

Two Hundred and Twenty-Volt Metallic-Filament Lamps.—H. Lux.—An account of use of commercial 220-volt metallic-filament lamps. The results are given in the following table:

	Volts.	Amp.	Watt.	Hefner candles.	Watt per hefner candle.
Siemens & Halske, tantalum...	220	0.370	80.80	42.4	1.905
	220	0.360	79.20	45.0	1.760
Hollefreund & Co., zirkonium.	220	0.270	59.40	39.0	1.525
	220	0.268	58.96	38.1	1.545
Allg. Elektr.—Ges.....	220	0.250	55.00	39.0	1.410
	220	0.250	55.00	56.7	1.500
Bergmann	220	0.310	68.20	48.5	1.400
	220	0.300	66.00	48.5	1.360
Pintsch "Sirius-Colloidal".....	220	0.246	54.12	42.5	1.270
	220	0.252	55.44	44.0	1.250
Felten-Guilleaume-Lahmeyer...	220	0.265	58.30	35.5	1.640
	220	0.262	57.64	35.4	1.630
German Welsbach Co., osram..	220	0.263	57.86	44.5	1.299
	220	0.262	57.75	44.5	1.296
	220	0.260	57.09	42.2	1.355
	220	0.263	57.97	45.4	1.286
"Sun lamp".....	220	0.250	55.00	62.5	0.880
	220	0.345	75.90	68.2	1.110
	220	0.335	73.70	67.0	1.100

The osram lamps tested were from a former period of manufacture, so that the newer 220-volt lamps of this type would probably give better results. In most of the lamps a longer and thinner filament is used than in the corresponding 110-volt lamps. An exception is the Siemens & Halske tantalum lamp in which simply two 110-volt filaments are connected in series in one globe, so that this lamp has really two centers of light. With the exception of the last mentioned "sun lamp," all of the other lamps in the table give a more yellow light than the corresponding 110-volt lamps. The lamps are evidently used at a higher specific consumption than the corresponding 110-volt lamps.—*Zeit. f. Beleucht.*, Jan. 10.

Street Lighting from Interurban Railway Circuits.—G. N. Chamberlin.—The high-voltage transmission lines, made possible by the use of alternating current for traction, invariably render available a large surplus of railway-feeder material, a relatively large size of wire being necessary for mechanical strength. With this high voltage and ample material the variation is well within the allowable limits of both series and multiple transformation for lighting circuits. However, with the specially low frequencies used for alternating-current traction, the use of arc lamps connected directly to the railway circuit is questionable. The author describes the advantages of the series mercury rectifier with the direct-current luminous magnetite arc lamp, and describes the features of such a system.—*Gen. Elec. Rev.*, February.

Electric Lighting of Railway Cars.—E. Dick.—For train lighting the author considers the most suitable equipment to be the provision of each car with dynamo and battery so that all cars are independent of one another. He shows that the total weight of the equipment and the efficiency of the installation are very important factors which determine the economy. A minimum weight and maximum efficiency, together with greatest security of operation, are obtained with metallic-filament lamps if a single battery is used on the car and the generator is regulated for constant voltage and is self-excited.—*Elek. Zeit.*, Jan. 21.

Uniform Illumination.—E. W. Weinbeer.—An illustrated article on the construction of a reflector to give a uniform floor illumination in a room. The formulas are given for calculating the required form of the reflector which is used with incandescent lamps. A second article deals with similar arrangements to produce a uniform illumination within a room—that is, uniform illumination of floor, walls and ceiling.—*Zeit. f. Beleucht.*, Jan. 10 and 20.

Arc Lamps.—C. Heim.—An article on the regulation of arc lamps with inclined electrodes, dealing especially with the extent to which the operation of such lamps is influenced and improved by the use of a blowing magnet.—*Elek. Zeit.*, Jan. 21.

Goniometer Lamp.—F. E. Wright.—The goniometric measurement of minute crystal faces requires a source of illumination of such intensity that the author has formerly employed an electric arc lamp for the purpose. The Nernst lamp would be a very good source of light for this purpose if it were not for the unreliability of the filament. A new acetylene lamp has also been constructed; this is illustrated and described.—*Am. Jour. of Science*, February.

Generation, Transmission and Distribution.

Electric Power Supply.—G. L. Addenbrooke.—A lecture before the Society of Arts in London. The author estimates that about ¼ electric hp is used per head of population in England for all purposes. There is probably about 4,000,000 hp of engines in England which could be economically replaced by electric motors receiving energy from properly grouped stations. To prove that the larger stations have many advantages with respect to capital expenditure he gives the following table:

Available output of station, kw.	Cost of power house per kw available.	Allowance for distribution system per kw.	Initial expenses, including working capital.	Total costs per kw available.	Capital cost of undertaking.
2,500	$120	$100	$60	$280	$700,000
5,000	100	80	50	230	1,150,000
10,000	85	70	40	195	1,950,000
20,000	75	60	30	165	3,300,000
40,000	70	50	25	145	5,800,000

The figures in this table are stated to have been taken from actual working practice.—Lond. *Electrician*, Jan. 22.

Waste.—A. B. Gridley.—A paper read before the Cleveland and Durham Engineering Society on the application of electricity for the reduction of waste. The author discusses the advantages of buying electricity from a large plant. Electricity when purchased from an outside source at a reasonable price saves (1) waste of capital expenditure, (2) waste of labor, (3) waste of coal, oil, water and stores, (4) waste of time, (5) waste of space, (6) waste of energy in shafting and belting, (7) waste of taxes and insurance, (8) waste of "waste," and increases the output, the facilities for developing business and the industries in the neighborhood. Under waste of "waste" the author means the non-utilization of exhaust steam, waste heat, or combustible gas. The author finally discusses what is a "reasonable price." In the production of electricity for industrial purposes "the cost per unit by itself conveys nothing of any material importance, and it would be a great step gained if this fact were grasped and admitted. The price per unit conveys nothing unless accompanied by a definite statement as to load factor, and supplemented by details, such as total annual consumption, etc. It is, indeed, misleading." There are consumers deriving their supply at 1.1 cents per kw-hour who bring more profit to the producer than others paying 2.5 cents per kw-hour. It is only fair, therefore, for the purchaser to debit himself with, if he generates, or to pay, if he purchases, a definite lump sum to meet capital charges, entirely apart from the amount of energy consumed. The load factor has a very important effect upon the average price per kw-hour obtained. If a flat rate of, say, 1.5 cents per kw-hour were charged, the supplier would lose heavily in the case of a 25 per cent load-factor consumer, and the 75 per cent load-factor consumer would pay an extravagant price.—Lond. *Electrician*, Jan. 22.

Electric Motors in Paper Mill.—J. Liston.—An illustrated description of the equipment of the United Boxboard & Paper Company, in Lockport, N. Y. The sulphite and paper mills are electrically operated throughout by means of induction motors. The change from mechanical to electrical drive was made a year ago. The mechanical drive required 2250 hp and 528 hp was consumed in friction losses on shafting. At present, with a total equipment of 1700 hp in motors, the production is greater than it was with the old steam plant of 2250 hp. In addition to this, the amount of belting required has been reduced 50

per cent, in spite of the fact that most of the motors are arranged for belt operation. The motor-drive of different kinds of machines is described.—*Gen. Elec. Rev.*, February.

Coke-Oven Gas Plant.—A fully illustrated description of the Bargoed colliery installation of the Powell Duffryn Steam Coal Company. There are two coke-oven gas-driven gas engines, one of 1200 hp and the other of 2400, directly coupled to two alternators which supply the energy for the motors in the colliery.—Lond. *Elec. Rev.*, Jan. 22.

Traction.

Electric Traction on Railways.—H. E. O'BRIEN.—A paper read before the Liverpool Engineering Society on the possibilities of electric traction. The author first discusses main-line electrification, and shows that the locomotive cost per train mile for main-line service is 16 cents for steam and 16.6 cents for electric traction; the cost of fuel per mile being 4.5 cents in the former case and 9 cents in the latter. He sums up against electric traction on main lines. As regards urban and interurban service, the advantages of electric traction are more demonstrable, provided a largely increased traffic can be predicted, consequent of an improved service. The various systems of electrification are also discussed by the author.—Lond. *Electrician*, Jan. 22.

Gasoline-Electric Omnibuses.—At the (British) Society of Road Traction Engineers a discussion took place upon the relative advantages of gasoline-electric and gear transmission for omnibuses. W. A. Stevens gave figures of running costs, etc., for gasoline-electric omnibuses now being run in London, and compared these with the average of the remaining vehicles owned by the same firm, all of which are gear-driven. The total cost per mile for the gasoline-electric omnibus, including depreciation on the higher capital cost during the past year, was 17.04 cents, while the cost of the gear vehicles averaged 20.212 cents per mile. Mr. Stevens further stated that the gasoline-electric vehicle had run 28,000 miles without any trouble whatever. A. W. Windsor spoke in favor of other forms of transmission, and doubted whether the extra capital cost of the petrol-electric was justified. Col. Crompton thought Mr. Stevens had proved his case. At the same time, if the "Electrobus" had not come to stay, it would be a hard fight between steam and gasoline-electric.—Lond. *Elec. Eng'ing*, Jan. 21.

Installations, Systems and Appliances.

Brussels.—A. OSCHINSKY.—A continuation of his long illustrated article on the new electricity works of the city of Brussels. The author describes the cable network transmitting three-phase energy at 5000 volts from the generating station to the substations. The latter contain motor-generators, which provide direct current at 220 volts, supplied to a 2 × 110-volt, three-wire network.—*Elek. Zeit.*, Jan. 21.

Regulations.—Mr. James Swinburne's report on the proposed (British) Home Office regulations for the use of electricity in factories.—Lond. *Elec. Eng'ing*, Jan. 21; Lond. *Electrician*, *Elec. Review*, *Elec. Engineer*, Jan. 22.

Wires, Wiring and Conduits.

Cable Conduits.—H. BRICK.—The author recommends the systematic ventilating of conduits for telegraph, telephone and energy transmission cables. For these purposes he proposes the use of electrically driven ventilators.—*Elek. Zeit.*, Jan. 21.

Electrochemistry and Batteries.

Water Purification.—J. DON.—The first part of a fully illustrated paper read before the (British) Institute of Mechanical Engineers on the filtration and purification of water for public supply. Different kinds of filters are described and illustrated. Reference is also made to the use of ozone. The article is to be continued.—Lond. *Eng'ing*, Jan. 22.

Induction Furnace.—An illustrated description of some recent designs of induction furnaces, and also of the modified type of Roechling and Rodenhauser, in which the induction principle is combined with the use of pole-plates.—Lond. *Eng'ing*, Jan. 22.

Units, Measurements and Instruments.

Testing Outfits.—E. P. EDWARDS.—An illustrated description of testing outfits for college laboratories, especially of machines which embody in one piece of apparatus the salient characteristics of several commercial machines, together with the switchboard for controlling the machines.—*Gen. Elec. Rev.*, February.

Telegraphy, Telephony and Signals.

Transmission of Photographs.—L. DUBOIS.—An illustrated description of the apparatus of Korn for electric transmission of photographs. The system is commercially used between Paris and Berlin and between Paris and London. In general, the apparatus is worked over a double telephone line without using an earth return. Each complete apparatus of a station consists of a transmitter and a receiver, which are mounted side by side (Fig. 4). Both the transmitter and the receiver have a long box through which the light passes from the lamps *LL* at one end. The beam of light falls upon the rotating cylinders, which

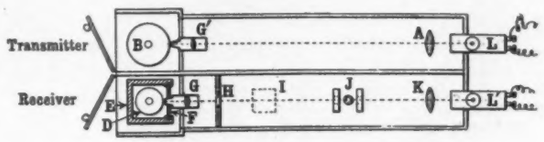


FIG. 4.—TRANSMITTER AND RECEIVER.

are mounted in a separate chamber at the other end. The principal details of the transmitter are represented in Fig. 5, which gives a vertical section of the apparatus. At the right-hand side is a Nernst lamp *L*, which is mounted within a sliding tube so that its distance can be readily adjusted. In front of it is placed the lens *A*, which serves to direct the beam of light toward the left. The beam is received in the sliding tube *G'*, which contains a lens and also a diaphragm in the smaller portion for concentrating the light and bringing it to a point upon the cylinder. The photograph, in the shape of a positive film, is placed around the glass cylinder *T*, which is mounted upon the rotating shaft *V* by means of the disk *U*, so that the cylinder can be readily removed from the shaft. The beam of light passes through the photographic film and is reflected upward within the cylinder by the totally reflecting prism *p*, so that the light is made to fall upon the selenium cell *S*, which is placed in the upper part of the chamber where it can be removed from the top. The glass cylinder is made to take a rotary movement and at the same time an upward movement by means of a revolving shaft combined with a screw, after the manner of a phonograph cylinder, so that all parts of the image on the film are made to come opposite the beam of light. The essential parts of the receiver are seen in Fig. 6, showing at the right-hand end the same arrangement of Nernst lamp, sliding tube and lens which are in the transmitter. The beam of light passes

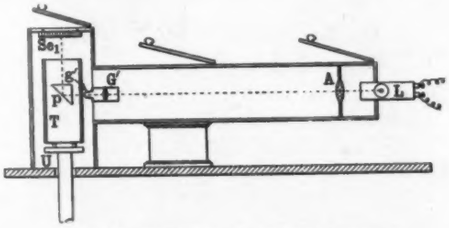


FIG. 5.—DETAILS OF TRANSMITTER.

toward the left, where it traverses the galvanometer shutter *J*. It consists of an electromagnet *d* having the pole-pieces *ee*, which project upward into the body of the instrument. These pole-pieces are perforated so as to allow the beam of light to pass through them. Between the poles is mounted a removable piece containing the moving part of the galvanometer. As seen in detail on the right, this consists of the double wire *a*—a very fine platinum wire—in tension, carrying a very small square of aluminum foil *b*. The portion composed of the wire and foil is extremely light. When current exists in the wire, the electromagnet being excited by a separate battery, the moving part is deflected to one side, the deflection depending on the current in the line. When no current exists, the aluminum square cuts off

the light beam almost entirely—that is, it throws a large shadow upon the screen *H* and lens *G* so that no light can reach the cylinder. When current exists, the shadow moves to one side and the beam can penetrate into the cylinder. The latter is shown at *D*; It is mounted upon a revolving shaft in such a way that all parts of the surface are brought successively under the beam of light from *g*. Thus it is seen that the variations of the image on the transmitter cylinder *T* will cause variable currents in the selenium cell *S*. These currents are received over

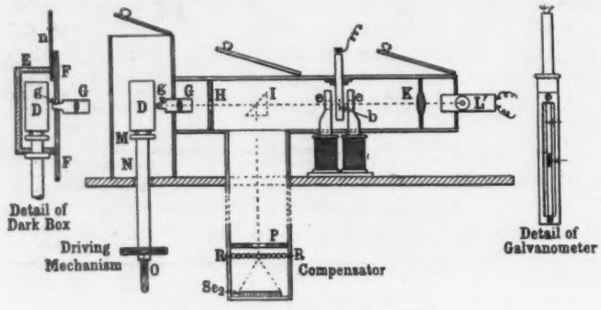


FIG. 6.—DETAILS OF RECEIVER.

the line by the galvanometer *J*. The shutter controls the amount of light according to the value of the current, so that the receiver cylinder *D* has an amount of light falling upon it at each instant corresponding with the thickness of the original film. In this way the photographic film placed upon *D* will receive the corresponding series of impressions, so as to reproduce the original image. In practice, the receiver cylinder is smaller than the one used for the transmitter, but both cylinders are rotated at the same rate by synchronous motors. A reduced image is, therefore, formed upon *D*. The compensating action for overcoming the inertia of the selenium is secured by the use of a second selenium cell connected with the cell of the transmitter so as to give a combined action of the two cells. The light is directed upon the compensating cell at practically the same time as upon the cell *S* by means of the galvanometer *d*. It is to be noted that the complete apparatus contains a transmitter and a receiver mounted side by side. In station *I* the transmitter is operated, and hence the receiver is out of use. This allows its galvanometer to be used for operating the compensator. Instead of illuminating both cells directly at the same time, as might be done, it is preferred to light the second cell by means of the galvanometer. It is accordingly placed in the vertical chamber of the receiver at station *I*, into the path of the beam, the light is reflected down upon the selenium cell. When the first cell Se_1 is illuminated, a current is produced in the neighboring galvanometer *J*, and a corresponding illumination is given to Se_2. Cell Se_1 and cell Se_2 are connected in opposition after the manner of a Wheatstone bridge, and upon the line, so that the latter receives the differential current of the two cells. This current is found to respond much better to the variations of light than that from a single cell, owing to the fact that the two cells are different in character. The light is diffused upon the compensating cell Se_2 by means of the set of glass rods *RR*. The receiver cylinder is enclosed in a dark box *E*, which can be closed by a slide *n*. This box slides upon the part *F* permanently fixed to the lens tube *G*, so that the box and cylinder can rise along with the rotating shaft, while the lens, tube and slide *F* remain fixed. When the operation is complete, the slide *n* is closed, and the box is removed from the apparatus for developing the film.—Lond. *Electrician*, Jan. 22.

NEW APPARATUS AND APPLIANCES

Non-Fragile Tungsten Lamps.

The accompanying illustrations show, respectively, a 110-volt and a 220-volt "Gral" tungsten lamp, the complete output of which is controlled by the Armorduct Manufacturing Company, Limited, of London, England. The lamps are shown one-half

"GRAL" TUNGSTEN LAMPS.

actual size, and diminution in size as compared with lamps of equal candle-power is one of the features to which the manufacturer directs attention. The method of supporting the filament has, it is claimed, much to do with decreased breakage. Platinum hooks possessing great flexibility are used for this purpose. Where rigid hooks are employed the maker claims that the fracture of the filament generally occurs on the actual support because the filament is not given the necessary freedom of movement. The lamp is proportioned to have a specific consumption of 1.1 watt per hefner candle-power when delivered; but after some 50 hours' burning the specific consumption is said to be reduced to 1 watt. A highly satisfactory life is asserted to be the result. The lamps burn in any position without appreciable sag, the manufacturer claiming that the flexible platinum hook permits of properly proportioning the filament as regards length to guard against any excess in this respect.

Regulator for Maintaining Constant Load Upon a Generating Station.

The desirability of maintaining constant load upon a generating station is generally conceded by engineers. The use of a storage battery in conjunction with an automatic regulating system forms an excellent solution of the problem. Evidently the success of such an arrangement depends largely upon the regulator. The regulator must be sensitive, yet stable in its action. It must be reliable and simple to take care of, and must be capable of permitting, quickly and easily, a wide range of adjustment of the generator load to take care of average load conditions. In other words, it is to the battery system what the governor is to a steam engine. It is claimed that all of these requirements have been met by the type of relay regulator shown in the accompanying illustration.

Fig. 1 shows the log of a battery and regulator test, with a constant rotary load and a variable external load, made at the plant of the Southern Colorado Power & Railway Company. The load is due to a railway system operated by the company

in the city of Trinidad, Col. The system comprises street railways in the city of Trinidad and an interurban railway running through mining towns for a distance of 13.5 miles.

The company operates from four to eight cars, during light traffic three city cars and one interurban, and during heavy traffic five city cars and three interurban cars. During certain parts of the day it also uses one of the interurban cars as a locomotive to haul standard 50-ton coal cars.

It will be noted that the average load runs about 100 kw, while the maximum reaches upward of 400 kw.

The generating plant consisted of one 200-kw, 550-volt, direct-current generator directly connected to a steam engine, three engine-driven, three-phase alternators rated at 105, 165 and 600 kw, respectively, and a 250-kw, two-phase rotary converter operating from a three-phase circuit.

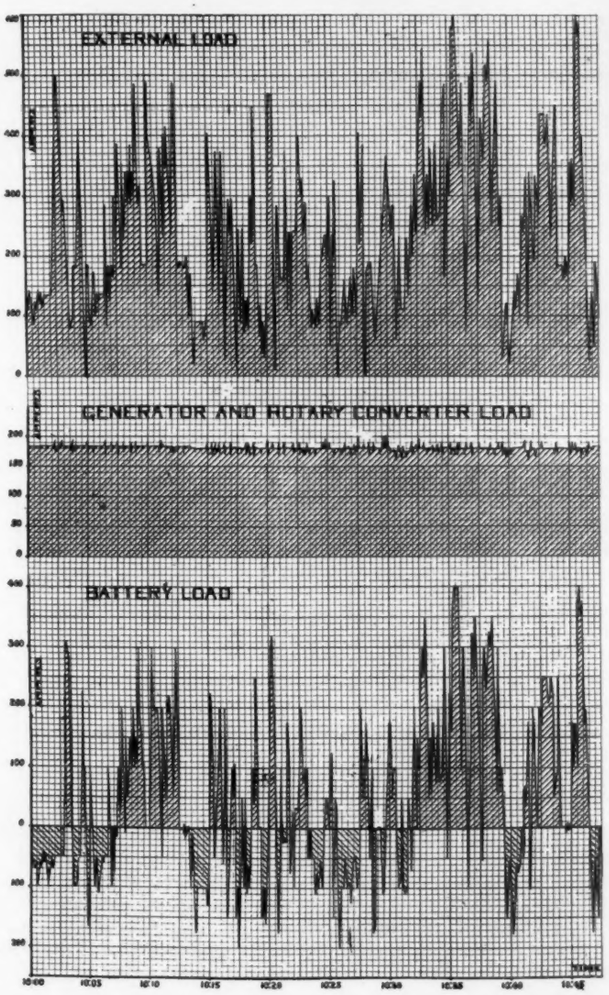


FIG. 1.—CURVES SHOWING THE EFFICIENCY OF THE LOAD REGULATOR.

Before the installation of the storage battery and regulator it was necessary for a great part of the time to keep both the 200-kw steam-driven unit and the rotary converter in operation. Since that time either one of the units is ample for the entire direct-current load.

Fig. 2 shows the switchboard with booster set at this installation, while Fig. 3 shows the regulator, which can also be seen in Fig. 2.

In this system of regulation the e.m.f. of the booster, or boosted rotary, as the case may be, is changed by changing the excitation of a single separately excited field winding. This field winding receives its energy from a small exciter which has, in addition to a self-excited shunt winding, two equal and opposite pilot field windings. The current in these two windings is controlled by the making and breaking of the double relay contacts *E* in Fig. 3. These contacts are in turn controlled by the primary relay of the regulator, which consists of a series member *A* working in conjunction with the shunt member *B* to close or open the energizing circuit of the relay magnet *D*.

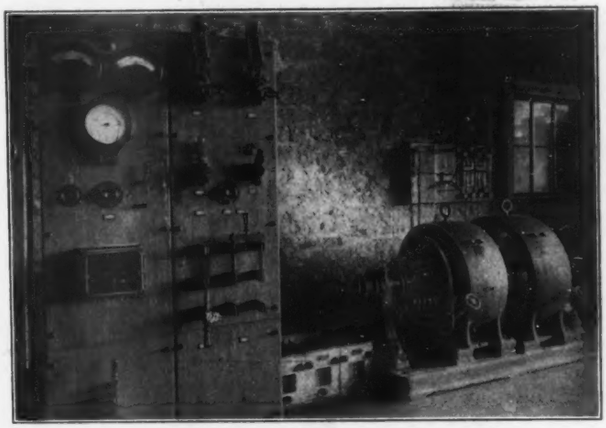


FIG. 2.—SWITCHBOARD AND BOOSTER SET FOR LOAD REGULATOR.

The series coil *A* works in a permanent magnetic field, and is balanced by an adjustable spring tension. The amount of current in the coil *A* is proportional to the current in a shunt—in the circuit to be controlled—to the ends of which the terminals of the coil are connected. This is equivalent to an ordinary ammeter movement, with the exception that the range of motion is exceedingly small.

The shunt coil *B* is exactly equivalent, excepting that its position varies according to the voltage of the booster exciter.

The primary relay contact *C* is established by the conjunction of the series and shunt-coil levers. This contact, therefore, intermittently energizes the electromagnet *D*, which operates the main relay contacts *E*. The lower contact *E* energizes one of the pilot fields, while the other contact *E* energizes the equal and opposite field. These pilot fields act in opposition so that with equal currents in the two coils there would be no voltage upon the exciter.

If one of them receives exciting current, it will tend to start up the exciter voltage in a given direction, but the shunt coil of the exciter will tend to carry the field to full saturation. This action will be checked by the shunt coil of the relay. It will thus be seen that, as the external load changes on the system, the contact is broken, the booster voltage is raised due to the exciter voltage rising, and the battery is caused to discharge.

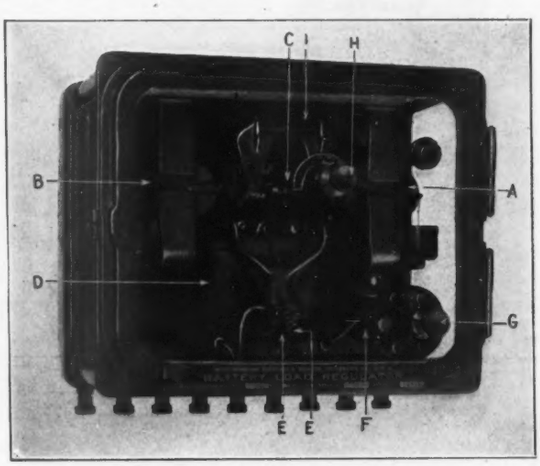


FIG. 3.—BATTERY LOAD REGULATOR.

This discharge, which will continue at an increasing rate until the operating equilibrium of the system is again restored, is entirely independent of the conditions of the battery charge, or discharge as long as there is enough booster pressure behind the

battery to give the required discharge to maintain the load constant. On the other hand, if the load decreases the opposite effect is secured, namely, the other pilot coil tends to cause the exciter to build up in the opposite direction; this action is further aided and carried to a maximum by the shunt coil, thereby causing the battery to charge.

The above-described regulator has been placed on the market by the Westinghouse Machine Company, Pittsburgh, Pa.

Inter-Communicating Telephones.

The wall and desk telephones illustrated herewith exemplify the possibility of designing types of instruments for inter-communicating systems having ultimate capacities of from 20 to 30 regular stations, respectively, and each with a trunk-line connection to a distant exchange. Installation of 10-station systems using telephones of correspondingly decreased proportions are more common than these, but systems employing telephones of these greater capacities have proved practicable for inter-communicating service in large office organizations, such as are found in banking and mercantile institutions.

Considering the operation of inter-connecting one station with any other, the important mechanical feature of these telephones is the "push-button" key provided with either 12, 22 or 32 key buttons for the three capacity instruments. The key operates when mounted in any position but, for the sake of assistance in describing its parts, consider it mounted at present in a vertical position, as shown in the illustrations. Extending outward right and left in pairs, from each row of key buttons, in a horizontal position, are the main contact springs terminating just beyond the key base in free view. Both main operating springs which engage a plunger bushing that comes down between them, and the inner pointed platinum contact springs, are mounted in sets on edge in milled hard-rubber strips paralleling the rows of key buttons and are fastened securely in this position to the metal key base-plate. The object of this construction is to provide positive action between the plunger and the contact springs and permit a direct single connection to be made between the cable conductor and the contact springs. The ends of the main contact springs extending beyond the key proper are formed in

FIG. 1.—INTER-COMMUNICATING 30-STATION DESK TELEPHONE.

such a manner as to make a neat and strong screw terminal, which eliminates soldered connections and provides one contact point between the cable conductor and the key.

In the key box or wall telephone the switching device is mounted independently of all other parts in the backboard, which arrangement gives free access to a very simple design of key. There are no spiral springs or delicate parts required for operating the tumbler plate which shifts with the depressing of any key button, which is held until automatically restored upon depressing another button to call a different station. The ringing

FIG. 2.—INTER-COMMUNICATING 20-STATION WALL TELEPHONE.

button, which works independently of the tumbler plate, is the last lower button of the left-hand row of keys.

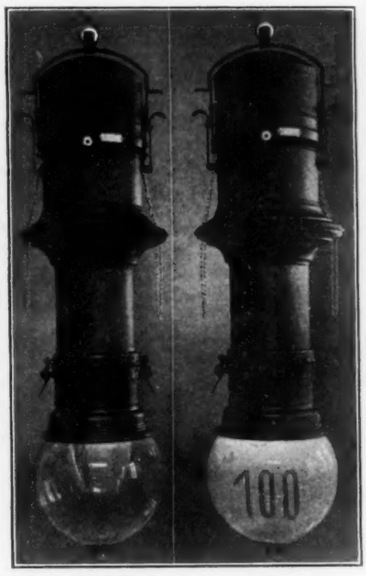
Metallic circuits are employed for all of the various kinds of services for which these telephones are adapted. When the maximum distance between any two stations is 1300 ft. or less the ringing battery—of dry cells—should have a potential of about 12 volts and the talking battery about 9 volts. By operating the inter-communicating system on a slightly higher voltage employing small battery wires in the cabling, the expense for this part of the equipment is decreased and much better and more positive operation assured.

Inter-communicating telephones of the type here noted are made by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., for common-battery systems consisting of from 2 up to 30 regular stations and one or more trunk-line connections. The same standard apparatus for the talking circuit is used in these sets as for local and long-distance service. A detachable switch-hook is furnished with the wall telephone.

Efficacy of Ventilating Ash Trays on Flaming-Arc Lamps.

In the issue of Jan. 2 there appeared a description of the Excello flaming-arc lamp fitted with an inner prismatic globe. The results of tests made by the Electric Testing Laboratories were also given in the article. Incidentally it might be mentioned that not a little of the good showing may be attributed to the use of the ventilating ash tray with which the lamp was fitted. In order that a comparison might be had between the ordinary flaming-arc lamp and one equipped with an inner globe, an ordinary Excello lamp and one fitted with the inner prismatic globe were used in the test. The lamps were fitted with the ventilating ash tray at the bottom of the clear outer globe used in both cases. The accompanying illustration shows a photograph of both lamps after the test and tells its own

story. That the type of ventilating tray employed was not of much use without the inner globe is shown by the deposit on the inside of the clear outer globe, the number shown being written with a finger on the clouded globe. In its report to the Excello Arc Lamp Company the testing company drew attention



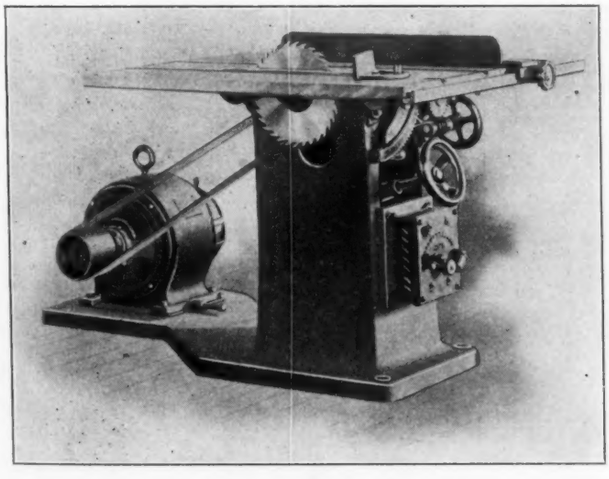
VENTILATED LAMPS WITH AND WITHOUT INNER GLOBE.

to this deposit upon the inner surface of the globe after five hours' burning, adding that the prismatic inner globe showed very little evidence of deposit.

Motor-Driven Table Saw.

A tool for woodworking establishments which is to be especially interesting on account of its convenience, efficiency and neatness, is a motor-driven table saw manufactured by the Crescent Machine Company, Leetonia, Ohio, illustrated herewith.

The saw table proper and the saw itself are supported upon a pedestal which also furnishes a frame, upon which the mechanism for adjusting the saw and table and the starting rheo-



MOTOR-DRIVEN TABLE SAW.

stat are mounted. This adjusting mechanism consists of means for tilting the table and raising or lowering the saw. The former is accomplished by means of a hand-wheel whose shaft bears a worm, with a graduated brass scale and pointer to show exactly the amount the table is tilted up to 45 deg. By means of the other hand-wheel the saw is adjustable in a vertical direction, making the machine adapted for cutting boards of different thicknesses up to 4 in. The saw itself may be as large as 14 in., but no larger.

The motor equipment consists of a 3¾-hp totally enclosed Westinghouse motor and a starting rheostat. It is a shunt-wound, direct-current motor, running at a constant speed of 1800 r.p.m. on a line voltage of 220. The rheostat is equipped with an automatic low-voltage release, and is used for starting only. The motor is mounted on the extended base of the saw table proper. It is connected to the saw mandrel by a belt which passes through an opening at the back of the pedestal.

A reference to the illustration shows the extreme ease of operation brought about by the motor equipment. The five operating handles are all within a radius of about 1 ft. The table can be tilted, the saw raised or lowered, the ripping and cut-off fences adjusted and the saw started or stopped without the operator moving a step. The motor is behind the machine out of the way, and takes up no space that would otherwise be useful, being beneath the overhanging table. The machine can be located in any position desired, being independent of line shafts. A minimum amount of power is wasted, nothing being consumed by extra belts, countershafts, etc. It should be further noted that a saw of this kind only operates intermittently, and the absence of a main shaft and countershaft is thus particularly advantageous, since power is only used when work is actually being done. Altogether this constitutes a fitting example of the advantages of the motor drive and the absence of the disadvantages of the mechanical drive.

Use of Pure Soot in Carbon Manufacture.

BY H. CAIRD.

In the manufacture of arc-lamp carbons it is of paramount importance that the raw materials used be pure, as the least amount of impurities causes spitting, unsteadiness and heavy ash deposit. As a result of the conditions imposed the very few varieties of materials which can be used are soot, retort carbon and the carbon residues from petroleum or tar.

Soot is the best but most expensive of the materials used. It is produced by imperfect combustion of tar, pitch, naphthaline, oils or residues and if prepared with care, takes, with regard to purity, the first place among the raw materials employed, requiring only to be passed through a screen to eliminate impurities.

Retort carbon is formed during the distillation of coal in the manufacture of illuminating gas. It is deposited on the wall of the retort in the form of large steel-gray pieces of great density containing many impurities which must be removed by wire brushes or other mechanical means before it is suitable for the manufacture of carbons. Petroleum coke is obtained as a residue in the distillation of mineral oils. Petroleum contains numerous volatile constituents which have to be driven off by heat before it can be used in the manufacture of carbons. Petroleum coke, like retort carbon, presents a great resistance to combustion.

The hardness of arc-lamp carbons depends largely upon the composition and the method of baking. It affords a good criterion with respect to the material of which the carbon is composed, but gives no indications as to the probable behavior or the rate of consumption when burning. Carbons made of soot are invariably harder than those made of petroleum coke. When passing upon the quality of carbons, it is well to remember that longitudinal fissures are in no way detrimental, but on the contrary indicate that the carbons have been thoroughly baked—a most desirable feature.

The consumption of carbons not only depends upon their composition, but also upon the conditions under which they burn. In carrying out consumption tests every precaution should be taken, as test results with carbons of the same make, burning in the same lamps and under identical conditions as to

current and voltage, may vary 10 per cent or more. The subject of ash deposit is of prime importance in that a heavy deposit of ash cuts off a large percentage of light. Tests indicate that carbons made of the best quality of soot leave about 2/10 per cent of ash, while carbons consisting of a mixture of soot with less combustible material leave from 0.5 per cent to 2.5 per cent of ash, depending on the proportion of soot.

The actual commercial efficiency of an arc lamp is judged by the amount of useful light given, and an important fact has been established, namely, that the light emitted by carbons made of soot is approximately 20 per cent greater than that emitted by carbons made from petroleum coke and retort carbons. The use of pure soot carbons is a step in the right direction and should be insisted upon, as manufacturers in their mad rush for new illuminants with high efficiencies have frequently overlooked the actual needs of users of enclosed arc lamps. The Central Electric Company, of Chicago, handles a line of imported pure soot carbons suitable for flaming-arc and other types of arc lamps.

Solenoid Starters for Alternating-Current Motors.

The accompanying illustrations show several applications of single-phase plunger magnets for operating switches of alternating-current motor starters. The single solenoid, shown in Fig. 1, serves for operating a double-pole switch which may be used in the two leads of a single-phase, self-starting motor or in two of the leads of a two-phase or a three-phase self-starting motor, such as small squirrel-cage induction motors. Fig. 2 shows two of the single-phase solenoids arranged for operating double-pole switches for use with rheostatic starters for polyphase induction motors of the squirrel-cage type. One of the switches closes the main circuit to the motor, two resistors being inserted in two of the leads. The second switch short-circuits the two resistors after the rotor has reached the proper speed. The

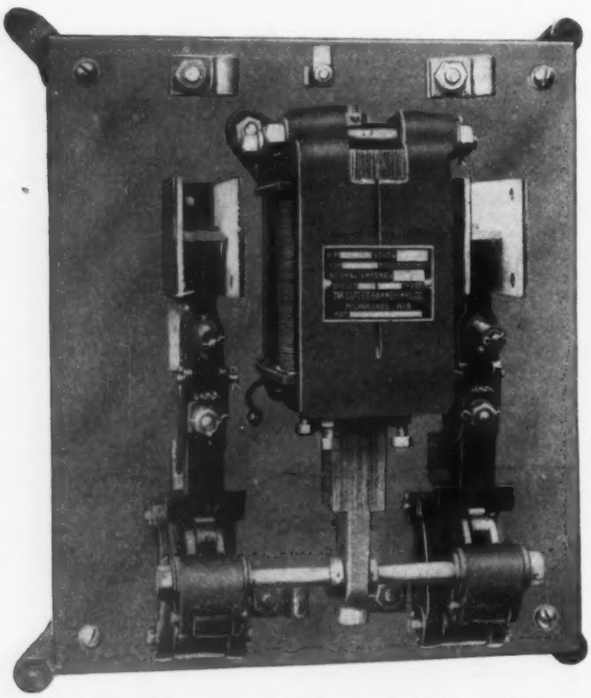


FIG. 1.—SOLENOID SWITCH FOR SELF-STARTING MOTORS.

acceleration of the motor is controlled by a series relay in the motor circuit, which will lift when the circuit is first closed and thus keep the starting resistance in circuit, but which will drop again after the motor has accelerated properly and will then permit the motor to be connected directly to the lines.

In Fig. 3 there is shown an assembly of four single-phase solenoids arranged for operating double-pole switches for starting slip-ring type induction motors for heavy service. The acceleration of the rotor is controlled by resistance in each of the three phases of the secondary circuit, which is cut out of circuit, step by step, by the two-pole solenoid switches under the

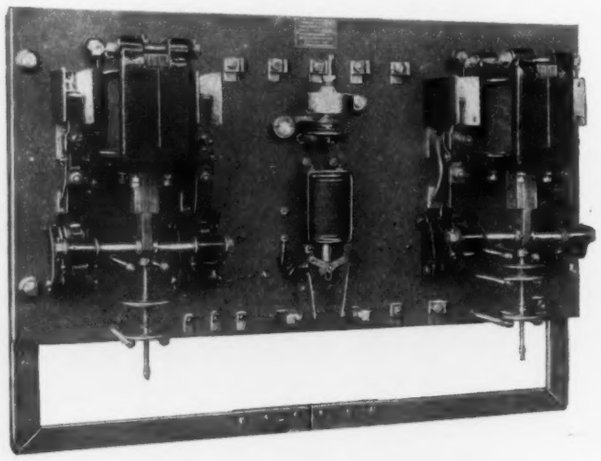


FIG. 2.—SELF-STARTER FOR USE WITH SQUIRREL-CAGE MOTORS.

control of the secondary current relays. The starting switches are interconnected with each other and with the primary switch, so that they will close in succession to accelerate the rotor after the primary circuit has been closed. The rate of acceleration is controlled by three-phase current relays in the secondary circuit, each arranged so as to prevent the following step of the resistor from being cut out of circuit when it is lifted by the starting current, but which will drop again after the motor has accelerated properly, and will then permit the next step of the resistor to be cut out. The starting current is limited to a predetermined and adjustable value by the current relays, and the motor is accelerated in the shortest time consistent with this value of starting current.

The above-described motor-starting devices are made by the

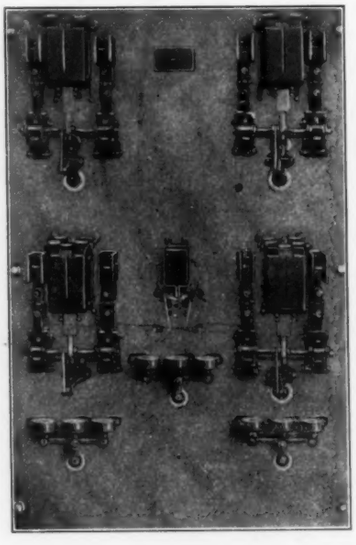


FIG. 3.—SELF-STARTER FOR SLIP-RING TYPE INDUCTION MOTORS.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., which has also developed starters involving similar single-phase solenoids for use with squirrel-cage induction motors employing auto-transformer starters and slip-ring induction motors for light service.

Carnegie Steel Company.

At the Duquesne plant of the Carnegie Steel Company a large ore-handling bridge has recently been installed by Heyl & Patterson, Inc., of Pittsburgh, Pa., which is the first bridge of its type built by this company, and possesses a number of interesting features. The bridge spans an ore yard of about 1800 ft. in length, serving six large blast furnaces. Adjacent to the furnaces are storage bins under which the lorry cars operate to

FIG. 1.—DUQUESNE ORE BRIDGE.

conduct the ore from the bins to the furnace skips. One supporting leg of the bridge rests on this bin structure, and the other is carried by a concrete wall 26 ft. high.

The bridge is of approximately 230-ft. span between trucks, and has a cantilever extension at either end of about 65 ft. The iron ore is brought within reach of the bridge by transfer cars, which operate between the car dumper 1000 ft. or more from the ore yard and run on tracks carried by the bin structure. These transfer cars discharge their load through an open track onto baffle plates, which form a temporary pile along the bin side of the storage yard. By means of the grab bucket the bridge gathers up the ore and places it in storage or removes it

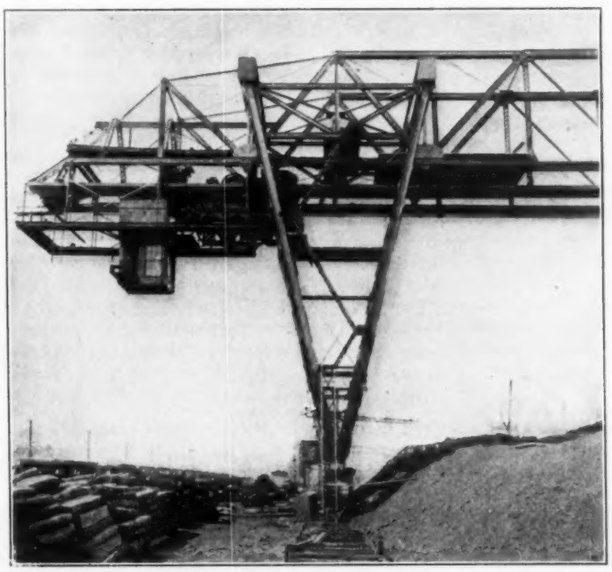


FIG. 2.—END OF DUQUESNE ORE BRIDGE.

from the storage pile and delivers to transfer cars for distribution into various compartments of the bins, from which the supply for the blast furnaces is drawn as needed. At the end of the bridge farther from the furnace a V-shaped leg furnishes the support, while at the furnace end a single shear leg supports the bridge, as is shown in the accompanying illustration.

Throughout the design of this structure flexibility was sought; this provides for the inequalities in travel of the two ends of the bridge and absorbs endwise shocks and thrusts, due to the quick acceleration of the trolley, without straining the bridge.

The bridge is propelled along its track by two 52-hp Westinghouse crane motors, one on each truck, controlled from the cab. The two controllers for these motors are set adjacent and are so arranged that a single handle moves either controller sepa-

FIG. 3.—YOUNGSTOWN ORE BRIDGE.

rately or both simultaneously. This arrangement allows one end of the bridge to be moved without affecting the other, and on a long travel, should one end of the bridge structure get in advance of the other end, the higher-speed motor will be retarded until the slow one overtakes it.

The bucket is a 10-ton Hulett patent excavating bucket, and is operated by two 225-hp Westinghouse crane-type motors of mill-type construction. The bucket with its load of ore weighs approximately 50,000 lb. The trolley-traversing mechanism is driven by a 225-hp Westinghouse mill-type motor, which motor is a duplicate of the two hoisting motors. The two buckets operating motors are geared together and operate by a single magnetic type controller, providing also for dynamic braking, thus removing a considerable item of wear in the shape of brake blocks from the trolley. The bridge is of very high capacity, having been constructed to handle 600 tons per hour. It has, however, within the last four months far outstripped this amount.

An equipment similar in all respects to this bridge has also been installed for the Youngstown Sheet & Tube Company, Youngstown, Ohio. This machine also is giving much satisfacton both as to speed and maintenance. The length of the Youngstown bridge is approximately 100 ft. greater than that of the Carnegie Steel Company, and the moving gear differs inasmuch as the bridge is propelled on its tracks by four motors instead of two, the trucks at all four corners being duplicate.

Cement for Pipe Joints.

As is well known, the red and white lead and the ordinary pipe-joint cements on the market are sold ready mixed with water or oil. In purchasing these, payment is made for the water and oil at the same rate as for the cement. To obviate this disadvantage the H. W. Johns-Manville Company, of New York, has placed on the market what is known as H-O pipe-joint cement. This cement is in powder form, and since it is claimed by the manufacturer that it does not dry out or deteriorate, can be kept in stock for a very long space of time. The chemical properties of the cement are such that the composition expands after the joint is made up, so that a tight joint necessarily ensues. Water or linseed oil is employed for making the mixture, and it is claimed that the joint will not harden to the same degree as red or white lead, so that it can be easily broken without danger of damaging the fittings.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

It was almost possible to hear a note of discouragement in commercial circles during the past week. The lull in business was even more pronounced than it has been at any time since the first of the year. Up to this time manufacturers and wholesalers have been comforting themselves with the belief that the turn for the better was near at hand. The fact that things seem to be even duller than heretofore is causing much complaint and some anxiety. Orders from the retail trade are very light for this season of the year and are so evidently being made only for the purpose of filling in to supply absolute necessities that they do not portend any continuation of business. The trade in building materials, lumber, paints and other kindred wares has not begun although spring is near at hand. Dealers announce the belief that as soon as the weather settles orders for these will begin to come in, but there is a fear that their tardiness may mean a restriction of building during the coming season. All branches of the metal trade are exceptionally dull. The iron and steel markets are weak and the reductions, which have been hinted at for weeks, are now being openly admitted. Cuts have been made in almost all material of this character with the exception of steel rails, wire and tubes. Pig iron is dull and is being sold mostly in small lots. Prices are being shaded and there is no doubt that production at the present time is far in excess of the actual demand. In the electrical trade the large manufacturing plants report that orders and inquiries are abnormally low. The majority of the business that is being done is in small machinery and minor appliances. Very few large installations are being contemplated in the immediate future. There are many projects talked of, hydro-electric and steam, throughout the West and South, but all of them are being held in abeyance awaiting the revival of business. It is not a question of raising money, for that is easily done with the bond market in its present greedy condition. The point that causes the promoters of these enterprises to delay and to hesitate at the present time is the lack of market for their energy after it is generated. With the manufacturing business at its present low ebb there is little use for investing in new power producers. Railway earnings, which by many are considered a barometer of trade conditions, while in excess of the same period of a year ago, continue to be lighter than the managers anticipated. The movement of grain, coal and other bulk freight is smaller than had been expected. Collections continue to be slow but they are no worse than they have been for several months past. There were 1318 business failures reported by *Bradstreet's* for January, 1909, which is a reduction of 22 per cent from the January previous. Failures for the week ended Feb. 4 were 286, against 311 of the previous week, 272 in the like week of 1908, 198 in 1907, 204 in 1906 and 207 in 1905.

THE COPPER MARKET.

The copper market still continues to droop and the outlook is uncertain. All efforts to rally prices or to stimulate consumption are proving unavailing. There is little demand for copper in the present condition of trade, and although prices have been marked down during the past week this demand does not seem to improve. The fact that what is called the official prices, those posted at the Metal Exchange, have been above the actual selling prices for weeks is well known. During the past few days there has been a disposition to make the quotation coincide with the actual market. The London market continues to be very weak and the demand abroad shows no more improvement than the demand at home. It begins to be apparent that the large consumers in this country expect the market to go lower and a representative of one of the principal electrical concerns was quoted last week as saying that he believed that the statistical position of copper would soon warrant a 12-cent price. With this view prevailing among the consumers it is not at all surprising that purchases at present figures are made only to fill absolute requirements. The first report of the copper producers associations will soon be made public, and it is understood that it will show a surplus in this country of about 125,000,000 lb. In many quarters this figure will not be accepted as being anything like large enough. Taking the government statistics together with what is known of the consumption, it seems apparent that the surplus in this country is near 200,000,000 lb. The statistics given out by the International Copper Producers Association show that the surplus stocks in Europe are 46,567 tons. The figures given out by both of these organizations must be considered as exceedingly optimistic. In the mean time the production of copper is going on as actively as ever, the imports are still fairly large and the exports are much below the record made at this time last year. There is coming into sight every month in the American market more than 100,000,000 lb. of copper. The exports and the consumption together at the present rate are not more than 80,000,000 lb. This state of affairs has existed for a number of months, and the accumulation is obvious in spite of all denials. The exports from New York for the month of February up to and including Feb. 8 were 5,034 tons. Quotations on the Metal Exchange on that date were as follows:

Lake	13½ @ 13⅝
Electrolytic	13⅜ @ 13¼
Castings	13 @ 13½

London quotations were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	58 7 6	58 7 6
Standard copper, futures	59 7 6	59 7 6
Market	Firm.	Steady.
Sales of spot		400 tons
Sales of futures		1,000 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	13.75
Electrolytic	14.25	13.25
Casting	14.12½	13.12½
London, spot	£64 2 6	£57 7 6
London, futures	64 17 6	58 7 6
London, best selected	67 15 0	61 15 0

MOTOR DRIVES FOR WOOD-WORKING FACTORY.—The John Hofman Company, a new wood-working factory located at Rochester, N. Y., has just closed a contract with the Crocker-Wheeler Company for an entire equipment of motors. The order includes 40 induction motors ranging from 1 to 30 hp, with a total capacity of about 200 hp. These motors will be used for individual drive, each machine being equipped with its own motor. The motors, with the exception of one, are of the squirrel-cage type. The generator for this plant and three lighting transformers are also included in the order.

NUMBER OF TELEPHONE STATIONS IN UNITED STATES.—According to the United States Government figures, prepared by the Department of Commerce and Labor, for 1907, there were in the country 3,132,063 Bell telephones and 2,986,515 Independent stations. These figures are probably the most accurate that can be obtained. There has been a vast increase in the number of stations since that time, but there is no method of ascertaining how great this is nor of determining the proportion between the Bell and Independent systems.

CROCKER-WHEELER CONVENTION.—The annual convention of the branch managers of the Crocker-Wheeler Company was held at Ampere, N. J., Feb. 8 and those who attended the meeting were entertained at dinner at the Machinery Club, New York, by the company on the same evening. The managers reported that they found business fairly brisk everywhere for small electrical machinery and that manufacturers everywhere were willing to consider the electrification of their plants or the installation of electric motors.

ASKS FOR GOVERNMENT PNEUMATIC TUBE.—Secretary Cortelyou, of the Treasury Department, has asked Congress for an appropriation of $175,000 for the purpose of building a pneumatic tube line from the custom house to the government bonded warehouse. It is stated that the old method of transacting business by messenger is too slow. There are 1,000,000 communications a year between the two offices.

JAPANESE PURCHASES.—The truth about the order for electrical goods placed by Japan which were exploited in daily newspapers as amounting to $7,000,000, in fact, amounted to something less than $700,000. The requirements of the Imperial government for the railroad electrification immediately at hand was divided into four contracts. The first of these consisted of equipment for a power house intended to furnish current to drive electric locomotives hauling trains outside the limits of the city. This contract was secured by the General Electric Company and consisted of three 1000-kw steam turbines, two 75-kw steam-driven exciters, switchboard and other power-house appliances. The second contract, secured by the Siemens-Halske Company, of Germany, consisted of 10 pairs of trucks, together with 10 sets of quadruple 50-hp direct-current railway motor equipments. The car bodies for these equipments were built in Japan and they are intended for suburban service in the neighborhood of Tokio. The third contract, secured by Takata & Company, of Tokio and this city, was for the equipment of a hydro-electric plant and consists of two 300-hp water turbines direct-connected to two 200-kw alternating-current generators, together with complete exciter equipments, transformer equipments, station switchboard, motor-generators, substation, etc. This plant is to furnish the power for the motor-cars used in the suburban service. The fourth contract, which is larger than any of the others, has not yet been let. It consists of 12 electric locomotives of about 50 tons each. The government is now receiving bids for these locomotives and also for rolling stock for the railroad. The line to be electrified serves not only Tokio, but seven other considerable manufacturing cities. It is understood that the government has decided to electrify all of the lines serving the more important cities of the country.

LARGEST CENTRAL STATION STORAGE BATTERY IN THE WORLD.—The New York Edison Company has recently closed a contract with the Electric Storage Battery Company for the installation of a battery at the Sixteenth Street substation which will, it is stated, be the largest single central station battery ever installed. It consists of 150 cells and has a capacity of 22,000 amp for one hour at about 120 volts. This battery is to be used for emergency service and is to be connected up to a set of the Electric Storage Battery Company's magnetically controlled, high speed, end cell switches. This makes the forty-first battery installed by the Electric Storage Battery Company for the New York Edison Company, the total capacity of all batteries now used by the latter approximating 193,000 amp at the one hour rate at about 120 volts. Two of the above batteries are used occasionally for exciter work, and added to these are two batteries which have ben installed for this exciter work exclusively, each having a capacity of 1500 amp at the one hour rate—making a total of 43 batteries in service.

ALUMINUM BUSINESS VERY DULL.—There has been practically no change in the price of aluminum for the past two or three months in spite of the fact that there is very little business being done by producers. Quoted prices are still about 24 cents a pound, but, as has been the case for months past, this figure can be shaded considerably. The best grades of aluminum can probably be bought at from 21 to 22 cents. Speaking of present conditions a representative of the Aluminum Company of America said: "We have never known, since the company was formed, business to be so stagnant as at the present time. In the line of wire and electrical aluminum we have not had a respectable inquiry for weeks. It is understood that the company has recently sold to the new municipal light and power plant of Winnipeg, Man., aluminum wire for its high-power transmission lines. The line will be operated at 66,000 volts for a distance of 75 miles. The towers will be 600 ft. apart and carry six wires. The total amount of wire sold was 450 miles. The size was 278,600 circ. mils.

THE HOSKINS MANUFACTURING COMPANY, Detroit, Mich., formerly of Chicago, Ill., moved into its new factory at the intersection of Lawton Avenue and Michigan Central Railroad, Detroit, on Feb. 1, where it will engage in the manufacture and sale of electric furnaces and pyrometers and other electric heating appliances. Later the company will develop a complete line of electric household utensils. The new factory occupies a ground-floor space 85 ft. x 200 ft. in area and is equipped with the most modern machinery, which will facilitate the manufacture of electrical apparatus. Mr. H. Ralph Badger, who has been associated with the publicity department of The Arnold Company, Chicago, Ill., has been appointed manager of the publicity department for the company, and will assume his new duties on Feb. 15.

EXCELLO ARC LAMP COMPANY.—Mr. H. M. Hirschberg, of the Excello Arc Lamp Company, has just returned from a trip throughout the West where he found a great deal of interest in the flaming-arc industry. The Excello company has added to its staff Mr. R. F. Pierce, who was formerly manager of the Minerallac company, Chicago. He will be located with the company in New York as general sales manager and publicity agent. The Excello company has also secured the services of Mr. P. Caird, an arc lamp expert who was formerly connected with the Central Electric Company, Chicago. Mr. Caird will be located in the Chicago branch in the capacity of engineer and assistant manager, and will be prepared to furnish engineering data and specifications to any customer contemplating a lighting installation.

PUSHING FLAMING-ARC TRADE.—The Stave Electrical Company, 27 West Twenty-seventh Street, New York City, has recently established a number of branches throughout the West for pushing the sale of the flaming-arc lamp of which it is the importer. The Chicago branch is at Room 1101, Monadnock Building; Pittsburgh, 407 Fourth Avenue; Detroit, Washington and State Streets; Davenport, Ia., Room 506, Lane Building; Cleveland, the New England Building. Branches will also be established in Philadelphia and Indianapolis within the next two weeks. The company reports that the interest in flaming-arc lamps throughout the West is rapidly increasing and that many cities and towns have under consideration plans for using them for street lighting purposes.

BIDS ASKED FOR ELECTRICAL EQUIPMENT.—R. S. M. Mitch, engineer of the Central City Refrigerating Company, of Syracuse, N. Y., has sent out specifications asking for bids for four gas-producer units of 250-hp each, two 500-hp gas engines for direct connection to generators, two 300-kw direct-connected generators, seven freight and one passenger electric elevators, motor-driven ventilating apparatus and a large amount of cork insulation. The Secretary-Treasurer of Lethridge, Alberta, Can., has asked for bids in connection with a municipal plant for steam-turbine generator, steam-engine generator, motor generator and transformers and switchboards.

GERMAN AGREEMENT AS TO PRICES.—The statement having been made some time ago that the price agreement syndicate of German electrical manufacturers had been dissolved, an official denial is now forthcoming. The management of the syndicate announces that the agreement is still operative and that there is no change whatever in conditions. The constituents to the agreement are the Siemens-Schuckert Works, the Allgemeine Elektricitäts Gesellschaft and the Felten & Guilleaume-Lahmeyer Works Company.

AMERICAN BLOWER COMPANY.—The American Blower Company, of Detroit, and the Sorocco Engineering Company, of New York, have been consolidated under the name of the American Blower Company. The plants at Detroit and Troy will continue in full operation. The prinicpal offices are in Detroit and 141 Broadway, New York.

STEAM TURBINE FOR MINING IRON ORE.—The General Electric Company has sold to Witherbee & Sherman a 1500-kw steam turbine and generator unit to be installed at Mineville, N. Y. The current will furnish power for ore mining purposes.

BOSTON EDISON STEAM TURBINES.—An unfounded report has been printed that the Boston Edison Company has purchased two 18,000-kw Curtis steam turbines. Some of the turbine generators now installed are, however, to be rewound.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market in Wall Street during the past week has been unusually dull, but prices have been rather more firmly maintained than during the latter part of January. As a matter of fact the stock market may be said, at present, to be simply marking time. It is waiting for something to turn up. It is waiting for the tariff to be settled, for business to resume and for many of the large enterprises which are contemplated, and for which, in many instances, plans are already drawn to have the courage to begin work. In the mean time, while there is little trading, there seems to be, except a certain pressure to sell Reading, no organized movement to depress prices. The

market is so well controlled and is so entirely in the hands of big financial interests that no little fellow dares to go short. There has been but one organized bear movement within the past year—that of A. O. Brown & Company—and every one knows the distressing fate which befell that firm. While the majority of outsiders are afraid to buy, every one of them is afraid to sell. The fact that the market is well under control has been shown by a few occurrences of the past six weeks. There were rumors concerning Colorado & Southern and there was a buying movement started from somewhere, but the public never found out what was going on until the insiders had loaded up with all the stock they wanted at cheap prices. Then, the Burlington deal was announced and the reason for the upward movement was explained. Almost the same thing occurred with regard to Chesapeake & Ohio. The insiders got in at low prices while the public knew nothing of what was being done. Shortly after the first of the year Brooklyn Rapid Transit began to advance, and the Street at once was filled with rumors that a dividend would be paid. This was asserted and denied on every corner, and there was no definite knowledge that a dividend was contemplated until it was announced last week. Again the insiders had profited by the advance information. The same sort of thing may be going on to-day in regard to some of the low priced Western stocks, for there are many rumors concerning the Gould properties. The public will probably remain in ignorance of any contemplated deals until after the stocks have had all the advance which may legitimately accrue from such deals. The money market continues to be easy and rates are cheap, in spite of the fact that the deficit in the United States Treasury is now more than $80,000,000, and promises to be $125,000,000 by the end of the fiscal year. Already Secretary Cortelyou has called upon some 300 national banks to turn back into the treasury by Feb. 24 about $30,000,000. There have been times that such a condition and such a call would create a monetary stringency, but not now. The banks, not only here but all over the country, are full of cash and they promise to remain full of cash until the money is needed by a general revival of business. The rates for call money on Feb. 8 were 2½ @ 2¾ per cent, 90-day paper was quoted at 2¾ per cent; the quotations in the table are those of the close Feb. 8.

NEW YORK.

	Feb. 1.	Feb. 8.	Shares sold.		Feb. 1.	Feb. 8.	Shares sold.
All.-Ch.	14½	14⅞*	400	Int.-Met., pfd.	41	43	8,205
All.-Ch., pfd.	46¾	47½	400	Mackay Cos.	72½	72	800
Amal. Cop.	73⅞	75¾	170,400	Mackay Cos., pfd.	70½*	71¼*	875
Am. D. T.	35*	35*	——	Manhattan Elev.	146	149*	149
Am. Loc.	56	55⅞	5,770	Met. St. Ry.	31*	31*	——
Am. Loc., pfd.	112¼	111⅞	——	N.Y. & N.J. Tel.	114	114½	655
Am. Tel. & Cbl.	75½	75½*	——	Steel, com.	52¼	52⅜	140,928
Am. T. & T.	125¼	128	6,700	Steel, pfd.	114⅜	113⅞	14,090
B. R. T.	69¾	71½	130,475	W. U. T.	68¾	67½	1,000
Gen. Elec.	152¼	155¼	772	West'h., com.	79½	80	2,000
Int.-Met., com.	14⅞	15⅜	5,440	West'h., pfd.	120*	118	——

PHILADELPHIA.

	Feb. 1.	Feb. 8.	Shares sold.		Feb. 1.	Feb. 8.	Shares sold.
Am. Rys.	45	45*	——	Phila. Elec.	11¾	12	——
Elec. Co. of A.	11	11⅛	——	Phila. R. T.	27½	27⅜	——
Elec. Stor. Bty.	44	44½	——	Phila. Traction.	92*	93¼	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	54	53½	——

CHICAGO.

	Feb. 1.	Feb. 8.	Shares sold.		Feb. 1.	Feb. 8.	Shares sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	128	129	——
Chi. Rys., Ser. 1.	116*	116*	——	Met. El., com.	17*	17*	——
Chi. Rys., Ser. 2.	45	44	——	Nat'nal Carbon.	84*	84*	——
Com. Edison	108	108	——	Nat. Carb., pfd.	110*	110*	——
Chi. Subway	26½	26	——				

BOSTON.

	Feb. 1.	Feb. 8.	Shares sold.		Feb. 1.	Feb. 8.	Shares sold.
Am. Tel. & Tel.	125½	128⅛	——	Mex. Tel.	2½*	2½	——
Cum. Tel.	125*	125*	——	Mex. Tel., pfd.	5½*	5¼	——
Edison El. Ill.	250	250	——	N. E. Tel.	130⅞	131	——
Gen. Elec.	152	154½	——	W. Tel. & Tel.	8*	8*	——
Mass. Elec. Ry.	13	13¾	——	W. T. & T., pfd.	79*	79*	——
Mass. E. R., pfd.	62	65¾	——				

*Last price quoted.
Shares sold are for week Feb. 1 to Feb. 6.

DIVIDENDS.

Niles-Bement-Pond Company, quarterly, preferred, 1½ per cent, payable Feb. 15, common, 1½ per cent, payable March 20.

American Smelters Securities Company, quarterly, 1½ per cent on preferred "A," 1¼ per cent on preferred "B," payable March 1.

Brooklyn Union Gas Company, 3 per cent, payable April 1.

New Jersey & Hudson River Railway & Ferry Company, Edgewater, N. J., semi-annual, preferred 3 per cent, common 2 per cent, both payable Feb. 15.

Quebec Railway & Light Company, quarterly, 1 per cent, payable March 1.

Philadelphia Company, Pittsburg, Pa., semi-annual, preferred, 2½ per cent, payable March 1.

National Carbon Company, quarterly, preferred, 1¾ per cent, payable Feb. 13.

Toronto Railway Company, annual, 7 per cent, payable April 1.

American Telegraph & Cable Company, quarterly, 1¼ per cent, payable March 1.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, quarterly, common, 1½ per cent, payable March 1.

Brooklyn Rapid Transit Company, 1 per cent, payable April 1.

Galveston (Tex.) Electric Company, semi-annual, preferred, 3 per cent, payable March 1.

ELECTRIC COMPANIES JOIN FORCES.—Announcement has been made that the Fort Wayne (Ind.) Electric Works have assumed control of the Northern Electrical Manufacturing Company, of Madison, Wis. These two concerns are subsidiaries of the General Electric Company, through ownership of stock control, and their practical consolidation is for reducing expenses and simplifying the sales departments. The commercial organization of the Northern company will be merged into that of the Fort Wayne concern and both properties will be directed from the Fort Wayne office. The two concerns have been practically non-competitive, as the Fort Wayne plant has manufactured principally motors and apparatus for alternating current and the Northern plant has made machinery exclusively for direct current. Hereafter this line of distinction will be absolutely withdrawn between the two plants. In quite a number of cities each of the companies has maintained sales offices and these will in every instance be united. The New York office will be in charge of Mr. J. C. Lott at 30 Church Street. The name of the Northern Electrical Manufacturing Company will disappear and the business will be conducted under the name of the Fort Wayne Electric Works. The details of the combination are being worked out by Mr. F. S. Hunting, treasurer and sales manager of the Fort Wayne company.

ELECTRICAL CONSOLIDATION IN ARKANSAS.—The Russellville Water & Light Company, Pine Bluff, Ark., which was recently incorporated with a capital stock of $100,000, has acquired the franchise, privilege and property of the Russellville & Ozark Mountain Light & Transit Company, which was organized in June, 1907, to build a light and water plant at Russellville, Ark., and an electric road from that city to Dover. A contract has already been let for constructing a 400-ft. dam across the Illinois River, which will give a 25-ft. head of water. Power will be generated by four turbine wheels which will develop about 500 hp. A light plant was established by the company a year ago. When the present work is completed the equipment will include one 150-kw generator in addition to the 100-kw generator now in service. Within a few months contracts will be let for the equipment of a waterworks plant to be electrically operated.

BONDS OF HYDRO-ELECTRIC COMPANIES.—William P. Bonbright & Company, bankers and brokers, of New York, have issued an interesting little pamphlet entitled "Investment Value of Hydro-Electric Securities." In it are discussed the history and development of hydro-electric power, special attention being given to the value for investment purposes of the first mortgage bonds of such concerns. The economy of operation, on account of the small amount of labor required, the small depreciation, the elimination of raw-material purchases and the stable market for the product are cited as especial advantages for such properties.

WISCONSIN BELL COMPANY NOT A TRUST.—Attorney-General Gilbert, of Wisconsin, has handed down an opinion holding that the Wisconsin Telephone Company, which is a Bell property, is not a trust as had been alleged in a petition filed by the Independent Telephone Association of Chicago. He declines to allow the Independents to begin suit for the forfeiture of charter of the Wisconsin Telephone Company. With regard to the merger of the Bell and Independent companies at Beloit, Wis., he says that the customers have expressed satisfaction over the better service they are receiving since the combination.

CHICAGO RAILWAYS EARNINGS INCREASE.—The rate of increase shown by the Chicago Railways Company during December was more than maintained during January. In fact, the increase in December was about 13 per cent and that in January about 15 per cent. The management of the road is inclined to give the pay-as-you-enter cars most of the credit for these gratifying increases. The officials say that if the same

ratio is continued throughout the year, the gross earnings for 1909 will be something like $12,000,000, or $750,000 more than the estimate made by Mr. Bion J. Arnold for the City Council in 1905.

WESTERN ELECTRIC'S YEARLY REPORT.—Although the exact figures have not yet been given out, it was announced at the annual meeting of the Western Electric Company, held in Chicago Feb. 4, that the earnings for the fiscal year of the company, which ended Nov. 30, 1908, showed a serious falling off from the year 1907. At the meeting L. Schoonmaker, president of the Manhattan Trust Company, New York, and F. R. Welles, manager of the company's European business, were elected directors to succeed A. C. Bartlett and W. R. Patterson. In his address to the stockholders, H. B. Thayer said that owing to the energetic sales campaign which the company had carried on during 1908 some departments of manufacturing concerns had been kept fairly busy. The total number of orders for 1908 were about 572,000, as compared with 479,000 during the previous year. The average value of the orders in 1907 was $98 and in 1908 was less than half that amount, or about $47. The total business, therefore, in round numbers, was about $47,000,000 in 1907 and $26,800,000 in 1908. This figure is a trifle less than that already published, as a preliminary estimate, which was $30,000,000. The debts of the company, according to President Thayer, had been reduced about $6,000,000 during the year, and on Dec. 1 only amounted to $11,500,000. The cash on hand and bills receivable amounted to $5,000,000 more than the total indebtedness.

BROOKLYN RAPID TRANSIT DIVIDEND—The Brooklyn Rapid Transit Company has at last declared a dividend after years of promising and scheming. The directors met Feb. 5 and declared a quarterly dividend of 1 per cent, payable April 1, adopting at the same time a resolution setting forth that "as dividends are declared they shall be made payable on the first days of April, July, October and January." The wording of this resolution is taken in financial circles to mean that while the company hopes to continue quarterly dividends it has not committed itself to their payment. The action of the directors it is expected will enable the company to place new bonds at smaller discounts. The company earned 4.6 per cent on its capital in 1908 which is the last report that has been made.

BELL TELEPHONE COMPANY OF PENNSYLVANIA.—The report of the Bell Telephone Company of Pennsylvania for the year of 1908 shows gross earnings of $11,434,520, an increase of $451,882 over the previous year. The net earnings of the company increased $184,381, and the surplus increased $38,387. This increase in earnings was accomplished in spite of the fact that the increase in stations during the year was only 12,148, or only about 4 per cent. The territory covered by the company is about 47,000 square miles, and includes a population of something like 8,000,000. It embraces all of Pennsylvania east of the Alleghenies and south of the northern tier of counties, southern New Jersey, District of Columbia, Delaware, Maryland, parts of Virginia and West Virginia.

NEW YORK & NEW JERSEY TELEPHONE COMPANY.—The report of the New York & New Jersey Telephone Company for the calendar year 1908 shows gross earnings of $9,269,407, an increase over the previous year of $462,314. The net earnings showed an increase of $333,997. The surplus for the year was $633,763, and the total surplus at the end of the year was $5,466,359. The percentage of gain in the number of stations during the year was 5.75 per cent, while in 1907 it had been 13.41. During the year 31,159 stations were connected and 22,586 were disconnected, leaving at the end of the year a net gain of 8373 stations. There was spent during the year $2,271,000 for equipment and improvements.

TORONTO RAILWAY'S GOOD REPORT.—The Toronto Railway Company, at its annual meeting, decided to increase its dividends to 7 per cent. It is announced that 1908 was the most prosperous year in the history of the company. The net earnings amounted to over 12 per cent on the capital stock after the payment of the city's percentage and the fixed charges. The total net earnings were $1,721,226, an increase of $103,264. The road carried during the year 89,139,571 paying passengers and there were 32,700,576 passengers who rode on transfers.

NARRAGANSETT ELECTRIC LIGHT COMPANY.—The annual report of the Narragansett Electric Light Company for the year 1908 shows gross earnings of $1,088,364 and net earnings of $442,356. The company paid dividends of 8 per cent during the year and added $14,903 to its surplus. This was after making the usual deduction of $75,000 for depreciation.

NEW DIRECTORS FOR LAKE SUPERIOR CORPORATION.—The directors of the Lake Superior Corporation have accepted the resignation of Messrs. F. W. Ayer and Thomas Gibson. Messrs. Gow and Whigham were elected to fill the vacancies. The new directors represent the Scottish interests which have recently come into the company.

CAPITAL TRACTION COMPANY, WASHINGTON.—The annual report of the Capital Traction Company, of Washington, D. C., shows that the total earnings from operation were $1,841,170 and the operating expenses were $793,141. The surplus for the year was $51,886, and the total surplus at the close of the year was $180,787.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Chicago Railways Company:					
November, 1908	$926,955	$689,270	$237,684	$153,570	$124,336
November, 1907	865,333	602,813	262,520	133,235	129,284
Detroit United Railways Company:					
Year 1908	7,114,760	4,559,123	2,555,637	1,618,665	1,001,928
Year 1907	7,100,885	4,492,544	2,608,341	1,569,261	1,099,726
Illinois Traction Company, Champaign, Ill.:					
Year 1908	4,098,620	2,354,124	1,744,496	.....	.....
Year 1907	3,779,187	2,128,488	1,650,699	.....	.....
Kansas City Railway & Light Company:					
December, 1908	576,140	325,275	250,865	156,089	94,776
December, 1907	512,666	216,197	251,469	152,178	99,291
Lake Shore Electric Railway, Cleveland:					
Year 1908	867,269	490,974	376,295	326,232	75,063
Year 1907	913,161	521,559	391,602	294,073	122,529
Manufacturers' Heat & Light Company, Pittsburgh:					
Year 1908	4,709,026	1,885,914	2,823,112	972,104	1,851,008
Year 1907	4,994,803	1,730,017	3,264,786	1,249,185	2,015,601
Metropolitan West Side Elevated Railroad, Chicago:					
Year 1908	2,746,840	1,410,801	1,336,039	1,084,750	261,415
Year 1907	2,878,587	1,443,498	1,435,089	1,050,123	391,785
New York & New Jersey Telephone Company:					
Year 1908	9,269,407	6,706,460	2,562,947	162,909	2,400,038
Year 1907	8,807,093	6,578,143	2,228,950	90,209	2,138,741
Ottawa Electric Railway Company:					
Year 1908	616,229	416,789	199,440	39,038	160,402
Year 1907	574,278	361,743	212,535	31,626	180,909
Pacific Coast Railroad Company:					
December, 1908	488,795	419,705	69,090	.....	.....
December, 1907	595,869	499,823	96,046	.....	.....
Philadelphia Company, Pittsburg:					
Year 1908	16,583,425	9,718,870	6,801,555	4,483,079	2,564,206
Year 1907	19,091,423	12,067,808	7,024,120	4,186,563	3,086,922
Portland (Me.) Electric Company:					
Year 1908	311,514	120,436	191,078	.....	.....
Year 1907	297,783	143,998	153,785	.....	.....
Savannah (Ga.) Electric Company:					
December, 1908	54,001	33,735	20,265	15,409	4,855
December, 1907	53,566	35,755	17,810	15,894	1,916
Southern New England Telephone Company:					
Year 1908	2,264,774	1,725,884	538,890	461,605	77,285
Year 1967	2,123,708	1,700,092	423,616	402,026	21,590
United Power & Transportation Company, Philadelphia:					
Year 1908	688,284	362,799	325,485	.....	.....
Year 1907	840,119	364,111	476,008	.....	.....
Western New York & Pennsylvania Traction Company, Olean, N. Y.:					
Oct. 1 to Dec. 31, 1908	150,870	68,019	82,851	.....	.....
Oct. 1 to Dec. 31, 1907	187,282	71,745	85,437	.....	.....

GENERAL NEWS

Construction News.

DOTHAN, ALA.—The citizens of Keyton Siding, Hodgesville, Newton Springs, and Mount Enon Church have organized a company to construct a rural telephone line from Dothan to Hodgesville. C. L. Jackson is president; J. D. Holton, secretary, and C. F. Gilstrap, treasurer.

FORT PAYNE, ALA.—The Alabama Railway & Power Company is planning to begin work on construction of its proposed electric railway between Chattanooga and Birmingham this year. The company also expects to furnish electricity for lamps. J. H. Hill, of Fort Payne, is vice-president.

TREADWELL, ALASKA.—Plans are being made to construct a hydro-electric plant to furnish electricity to operate the machinery in the Alaska-Treadwell mines. It is proposed to erect a plant on the Taku River, about 30 miles distant, to be transmitted to Treadwell, Mexican, Seven Hundred, Ready Bullion and Three Hundred mills and mines of the Treadwell group of Southeastern Alaska. The cost of the plant is estimated at about $750,000. Robert A. Kenzie is general superintendent.

PARAGOULD, ARK.—The City Council has granted the Crystal Ice Company a franchise to install an electric light plant to furnish electricity for lighting the streets of the city.

BISHOP, CAL.—Negotiations are being made for water rights on the upper King's River, where a large power plant to cost about $9,000,000 is to be erected. About 250,000 hp will be developed, which will be transmitted by electricity to various parts of the San Joaquin Valley, as far south as Los Angeles and north to San Francisco. Work on the plant will begin as soon as the weather will permit. The deal was consummated through T. L. Oddie, of Tonopah, and S. G. Musser, Big Pine.

FAIRFIELD, CAL.—The Council has granted a franchise to the Nixon-Kimmel Company to construct and maintain transmission lines for the distribution of electricity for lamps and motors and other purposes in Fairfield.

FORT JONES, CAL.—Notice of appropriation of water flowing in Fog Creek has been filed by P. A. Ball, which will be utilized for mining, power, irrigation, etc.

FRESNO, CAL.—The Fresno Traction Company has been granted a franchise by the Board of Supervisors to extend its Forthcamp line to the Wilson and North Fresno tracts.

LOS ANGELES, CAL.—The Edison Electric Company of Los Angeles is planning to enlarge its plants in towns surrounding Los Angeles, for which investigations are now being made by E. C. Jones, of San Francisco, who will make a report to John B. Miller, president of the company. The cost of the work is estimated at $500,000, and will include the plants at Pomona, Redlands, Riverside, Santa Barbara, Monrovia, Santa Monica, Ocean Park, Venice, San Pedro and Long Beach, Cal.

MACDOEL, CAL.—It is reported that W. L. and Thomas Prather are contemplating installing an electric plant at the Prather ranch, to furnish electricity in Macdoel and Mount Hebron for lamps and motors.

MAGALIA, CAL.—The power house of the Steifer mine was completely destroyed by the recent floods, and part of the machinery carried away. The plant will be rebuilt immediately, it is said.

MODESTO, CAL.—The La Grange Water & Power Company is constructing a large power plant on the upper Tuolumne River. The company will furnish electricity in Modesto for lamps and motors, and also proposes to extend a branch transmission line from the Turlock Company's storage reservoir, which will be used for emergencies and supply water to the Modesto irrigation district.

PETALUMA, CAL.—Plans and specifications have been prepared for the proposed high-pressure salt-water fire-protection pumping plant and submitted by the committee to the Board of Trustees. The report submitted recommends the installation of a 2500-gal. per minute pump to work at 150 lb., pressure to be operated by an electric motor of 300 hp. The Trustees authorized the clerk to advertise for bids for installing the plant.

REDWOOD CITY, CAL.—The city is reported to be receiving bids for constructing an extension to the municipal electric light distributing system.

ST. HELENA, CAL.—The Napa Valley Electric Company, recently incorporated, is now being organized and proposes to take over the property of the St. Helena Gas & Electric Company and will commence operations about April 1, 1909. The company will purchase electricity to operate its system from the Snow Mountain Water & Power Company. The officers are: D. L. Beard, president; H. J. Lewelling, vice-president; G. S. Conner, secretary, and H. Brown, treasurer.

SACRAMENTO, CAL.—During a recent storm the steel towers of the Great Western Power Company between Sacramento and Stockton, a distance of 10 miles, were blown to the ground.

SAN FRANCISCO, CAL.—Frank D. Stringham, representing the firm of Hillyer, Stringham & O'Brien, has applied to the Board of Supervisors for a franchise for a street railway system on several streets in the city.

SANTA CRUZ, CAL.—Work has commenced on the construction of the new electric power plant to be erected by the Vicente Lumber Company at Moore's Gulch.

SONORA, CAL.—Notice of appropriation has been filed by D. A. Jones of 20,000 cu. in. of water from the Tuolumne River, to be used for irrigation and power purposes.

STOCKTON, CAL.—A bill has been submitted to the State Legislature asking for an appropriation of $35,000 for the installation of an electric light plant and telephone system at the Stockton State Hospital.

COLORADO SPRINGS, COL.—The Empire Water & Power Company has purchased 320 acres of land near its sites on Cascade and Crystal creeks on the north slope of Pike's Peak, and has also secured options of additional territory. The company already owns 1200 acres, where extensive preparations are being made for an elaborate water system, which will be utilized for power generation. G. T. Bullock, of New York, N. Y., is president.

FORT COLLINS, COL.—At a meeting of the Chamber of Commerce, held Jan. 25, a committee was appointed to confer with the City Council in regard to establishing a municipal electric light plant. It is stated that the water power of the Poudre River could easily be utilized to generate power for the plant.

GREELEY, COL.—The Home Gas & Electric Company writes that it is contemplating the installation of a new municipal street lighting system, and may install series tungsten lamps. Additional machinery will also be installed in the plant. Robert McF. Doble, Majestic Building, Denver, Col., is secretary and manager.

MIDDLETOWN, CONN.—The Middletown Electric Light Company, it is stated, has decided not to enlarge its plant. A tentative contract has been made by which the Glastonbury Light & Power Company will furnish the Middletown Electric Company with all additional electricity needed.

SAYBROOK, CONN.—The New Haven Rigging Company has been awarded a contract for driving piles in connection with laying the foundation of the large power house to be erected by the Shore Line Electric Railway Company in Saybrook. The company proposes to construct an electric railway from Stony Creek east to the Connecticut River and north to Essex.

THOMPSONVILLE, CONN.—The new mill of the Upson-Martin Carpet Company has been completed and orders placed for new looms. Each loom will be operated by an individual electric motor.

TORRINGTON, CONN.—The stockholders of the Torrington Electric Light Company have voted to increase the capital stock of the company from $300,000 to $450,000, to provide funds for enlarging the power house and increasing the equipment of the plant.

WILMINGTON, DEL.—Three bids were submitted to the levy court for furnishing electricity for lighting the court house and operating various bridges, as follows: The Wilmington Light, Power & Telephone Company offers to furnish electricity for lighting the Third street bridge over the Christiana River at a rate of $20 per year for lamps of 16 cp, and for motors for operating the gates at a flat rate of $350 per year; for operating the safety gates on the Third street bridge, at a flat rate of $70 each per year; for lighting Market street bridge over Brandywine River, at a flat rate of $78 for each arc lamp; for lighting the Eleventh street bridge over Christiana River, at $78 per lamp per year, and for lighting the Washington street bridge over Brandywine River, at $18 per year for each 16-cp lamp. For furnishing electricity for lighting the court house lawn, at a rate of $78 per arc lamp per year, and for lighting the building, five cents per kw-hour. The county is to furnish the necessary motors and other equipment for power purposes at the Third street bridge over the Christiana River. The bid of the Wilmington City Electric Company, submitted, was as follows: Contract to include electricity for lamps and motors for four years, beginning Feb. 1: For each arc lamp, per annum, $79.20; for each 16-cp incandescent lamp, $18 per year; to operate the Third street bridge, $216 per year; for operating safety gates on each bridge, $60 per year, and for electricity for lighting the county court house, five cents per kw-hour. The bid of the Wilmington Gas Company was as follows: For furnishing electricity for lighting court house and Washington street bridge, $20 per lamp per year.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 16, for furnishing at the various naval stations and navy yards the following supplies: Norfolk, Va., Schedule 880—1000 ft. lighting wire and 4500 ft. interior communication cable; Schedule 884—150 lb. copper wire and 300 sq. ft. wire cloth, etc. Applications for proposals should designate the schedule desired by number.

MIAMI, FLA.—The Miami Electric Railway Company, which is in the hands of H. C. Roomes as receiver, has decided to abandon electricity as motive power and will operate gasoline motor cars.

PANAMA CITY, FLA.—It is reported that the citizens of Panama City are asking for a charter to construct a water and light plant for the town.

ATLANTA, GA.—The Piedmont Power Company has applied to the City Council for a franchise to construct and maintain an electric light and power plant in Atlanta.

COLQUITT, GA.—An election will be held to vote on the proposition to issue bonds to the amount of $15,000 for extension to the water and electric light systems.

DOUGLASVILLE, GA.—The City Council is considering the question of granting a franchise for the installation of an electric light plant.

HOGANSVILLE, GA.—The electric light plant owned by M. E. Word has been leased to Messrs. Lee, Newton and Roser. Through error this appeared under Hagansville, Ga., in the issue of Feb. 4.

ST. JOE, IDAHO.—It is reported that the Chicago, Milwaukee & Puget Sound Railroad Company will soon award contracts for the construction of two electric power plants on the Missoula River at St. Joe, Idaho Each plant will have an output of from 20,000 to 25,000 hp. The company proposes to operate its trains between St. Regis, Mont., and St. Joe, Idaho, by electricity as soon as the plants are completed. C. B. Pride, of Spokane, Wash., is engineer.

SOLDIER, IDAHO.—Plans are being considered by the Soldier Local Telephone Company to extend its system to Hagerman, Fendell, Glenn's Ferry, Shoshone and Jerome and also east and west of Soldier, during the coming summer. The proposed extensions and improvements will involve an expenditure of about $15,000.

WALLACE, IDAHO.—Arrangements are being made by the Slate Creek Electric Company to construct a hydro-electric plant on Slate Creek as soon as the weather will permit. The plant will have an output of 15,000 hp and will cost about $200,000. H. J. Rogers is vice-president.

CHICAGO, ILL.—Bids will be received by William Carroll, city electrician, 76 Fifth Avenue, Chicago, Ill., for furnishing and installing for the Department of Electricity electric light cable in accordance with specifications on file at the above office as follows: 1520 ft. 3-conductor, paper-insulated, No. 00 lead-incased cable; 150 ft. single-conductor, cambric-insulated, No. 00 lead-incased cable. Proposals must be made out upon blanks furnished by the city electrician.

CHICAGO, ILL.—We are informed that the Chicago, Blue Island & Joliet Traction Company will award contracts during the next two months for the construction of 17 miles of new track and for equipping 2½ miles of steam railway to be operated by electricity. The company will also award contracts for a 500-kw rotary converter and construction of a substation. W. H. Conrad, First National Bank Building, of Chicago, Ill., is general manager.

CHICAGO, ILL.—Proposals will be received at the office of the business manager of the Board of Education, Room 730, Tribune Building, Chicago, Ill., for electrical work for the Schurz High School, Milwaukee Avenue and Addison Street, in accordance with plans and specifications prepared by D. H. Perkins, architect of the board, and T. Waters, chief engineer, which may be seen at the office of the architect, Room 714, Tribune Building. Proposals must be made out on printed forms to be obtained at the office of the architect.

LOVINGTON, ILL.—It is reported that the Council has purchased the electric plant owned by A. J. Lewis & Company. It is said that improvements will be made to the plant. For further information address L. G. Hostetter.

PARIS, ILL.—The Central Union Telephone Company contemplates making extensions to its rural lines, for which an appropriation of $40,000 has been made. Roscoe Wright is local manager.

SHELBYVILLE, ILL.—A movement is on foot to consolidate the local telephone systems. It is proposed to organize a stock company with a capital stock of $30,000.

STERLING, ILL.—It is reported that A. M. Searles, of Chicago, Ill., has purchased water power rights on Rock River at Oregon, and proposes to generate electricity to be distributed in Rochelle, Amboy, Sublette and Franklin Grove for commercial and street lighting.

WAUKEGAN, ILL.—The London Investment Company, Ltd., of London, Eng., which recently purchased the system of the Kenosha Electric Railway Company, it is stated, will make extensions to the system, which will include the construction of all lines provided for under the franchises granted to A. C. Frost. The company will build street car lines to connect with the Kenosha baseball grounds and to the Northwestern depot at once. The extensions contemplated will involve an expenditure of about $125,000.

ANDERSON, IND.—At a joint meeting of the Board of Public Works and the City Council held recently it was decided to increase the output of the municipal electric light plant, at an approximate cost of $20,000. The plant now has an output of 1300 hp and the demand for electricity for motors is increasing rapidly.

MILLERSBURG, IND.—The Farmers' Mutual Telephone Company is planning to construct a telephone line to Topeka, and also to erect another line from Millersburg to Goshen. J. J. Zollinger is president.

WASHINGTON, IND.—The municipal electric light plant, which has been for the past year operated by the Washington Light & Water Company, has been again placed under the direct management of the city, a deed for the transfer of the property having been accepted by the City Council. A board of managers has been appointed. It is understood the city will make needed improvements in the plant this year.

WINAMAC, IND.—The Town Boards of Francesville, Medaryville and Monon have decided to construct jointly an electric power plant in one of the towns to furnish electricity for the three places; the three towns are situated about eight miles apart; each place has a population of about 1,200 and at present without electric service. The present plans provide for the erection of the plant at Medaryville, the central town, with transmission lines to Monon and Francesville.

ALBIA, IA.—We are informed that the Albia Electric Light & Power Company has been consolidated with the Hocking and Hiteman electric railways under the name of the Albia Interurban Railway Company. The company is capitalized at $250,000. The officers of the company are: L. T. Richmond, president; C. A. Ross, vice-president; Calvin Manning, secretary and treasurer; W. E. Gant, manager, and C. B. Judd, chief engineer.

CARSON, IA.—The telephone system owned by W. J. Way, of Carson, will be taken over by Musson Brothers Company, of Atlantic, Ia. It takes in the towns of Carson, Macedonia, Henderson and Treynor. It is said that the new owners will make improvements to the plant and replace the wire system with cables.

EPWORTH, IOWA.—The installation of an electric light plant in Epworth is reported to be under consideration.

GRAND JUNCTION, IA.—The local telephone company is making arrangements to erect a new telephone exchange in Grand Junction.

IOWA CITY, IA.—An election will be held Feb. 10 to vote on the proposition to grant a franchise to the Iowa City Electric Light Company.

MT. VERNON, IA.—The Cedar Rapids & Marion Telephone Company has purchased the plant of the Mt. Vernon Telephone Company. It is said the new company will improve the service by the installation of a complete metallic circuit and extend the system, work on which will begin early in the spring.

UNION, IA.—The Union Electric Light Company, which was recently granted a franchise to operate an electric light system in Union, contemplates the construction of an electric plant at a cost of $6,000. As yet no definite plans have been made. E. A. Hunt is secretary.

WILLIAMSBURG, IOWA.—We are informed that the Williamsburg & Iowa City Railway Company contemplates the construction of an electric railway between Williamsburg and Iowa City, a distance of 28 miles, contracts for which have not yet been awarded. F. O. Harrington, of Williamsburg, Iowa, is president.

LAWRENCE, KAN.—Albert Emmanuel and W. R. Sullivan, of Dayton, Ohio, have been in this city making investigations with a view of asking for a franchise from the City Council to establish a local street railway system in Lawrence.

NEW CAMBRIA, KAN.—Arrangements are being made by Charles Kirtland to erect an electric plant on Smoky River. It is said that the town is considering the question of installing electric lamps.

ROSEDALE, KAN.—The Kansas City & Olathe Electric Railway Company has applied to the City Council for a franchise to extend its railway into Rosedale. The company offers to furnish the city with five arc lamps along the route of the railway. R. W. Hocker, D. B. Johnson, J. J. Stewart and F. P. Dixson are interested in the company.

SYLVIA, KAN.—The question of establishing an electric light plant in Sylvia is under consideration.

CANE VALLEY, KY.—The village officials, it is said, have placed a contract for the installation of an electric light system in Cane Valley.

FRANKFORT, KY.—The Capitol Commission has awarded the contract for electric lighting fixtures for the entire building to the Mitchell, Vance Company, of New York, N. Y., for $25,000.

PAINTSVILLE, KY.—H. A. Loche, 547 Drexel Building, Philadelphia, Pa., has purchased a franchise for the construction of an electric light plant and water-works system in Paintsville. Work on construction of the plants will begin in about four weeks.

WINNFIELD, LA.—The plant and holdings of the Winnfield Light & Power Company have been purchased by W. P. Cooper. The new owner proposes to rebuild the plant and install new machinery, including dynamo, engine, switchboard and new line material. We are informed that this material will be purchased about Feb. 15. For further information address H. W. Wright, Winnfield, La., engineer in charge.

BRUNSWICK, MAINE.—Negotiations are practically completed for the sale of the Scribner water power privilege to the Brunswick Light & Power Company. This privilege gives the company the first rights on the lower dam of the Androscoggin River.

EASTPORT, MAINE.—Elijah Nichols has applied to the City Council for a franchise to construct and operate an electric light plant in Eastport.

FRIENDSVILLE, MD.—The Youghiogheny Power Company, recently incorporated, proposes to erect three dams, 30, 75 and 100 ft. high, respectively, on the Youghiogheny River and develop 15,000 hp. The cost of the work will be about $1,000,000. Clifford L. Pullen, of New York, N. Y., is interested in the enterprise. The Western Maryland Coal & Coke Company is said to be behind the project.

AVON, MASS.—The Edison Electric Company, of Brockton, instead of the Edison Electric Company of Boston, as stated in these columns Jan. 21, has applied to the Selectmen for a franchise to erect poles and wires on East Main and High streets. The company proposes to furnish electricity for lamps and motors for the shoe shop, and offers to place lamps on both East Main and High streets free of charge until the annual meeting in March, when the town will take action in regard to street lighting.

BOSTON, MASS.—The Edison Electric Illuminating Company, of Boston, is reported to have placed a contract with the General Electric Company for two 18,000-hp steam turbines to replace the two 7500-hp turbines now in operation.

BOSTON, MASS.—Negotiations have been completed by which the Edison Electric Illuminating Company, of Boston, is to purchase the plants and holdings of the Waltham Gas Light Company, the Newton & Watertown Gas Light Company, the Brookline and Brighton plant of the Boston Consolidated Gas Company and the Chelsea Gas Light Company. Contracts have been made by which the Edison company is to furnish electricity for operating all the street railway lines of the Boston Suburban Electric Company, and will also furnish electrical power to operate the street railways running through the Newtons and to Norumbega Park and to points south of Boston.

GLOUCESTER, MASS.—The Gloucester Electric Company has applied to the State Gas and Electric Light Commissioners for permission to increase its capital stock by $60,000, the proceeds to be used to pay floating indebtedness and for additions to its plant.

HOLYOKE, MASS.—Work has commenced on the new electric plant for the Lyman Mills in this city. The plant will have an output of 10,000 hp, with provision to increase it to 15,000 hp. The Roland T. Oakes Company, of Holyoke, Mass., has the contract for the installation of electrical equipment.

NORTH ADAMS, MASS.—R. L. Gardiner, city engineer, in his annual report recommends that all overhead wires be placed in underground conduits.

WAREHAM, MASS.—Plans are being considered to have the towns of Wareham and Marion unite to secure electricity for street lighting. It is proposed to secure electric service from the New Bedford & Onset Street Railway Company's plant at Wareham Narrows dock. It is probable that the question will be brought before the voters at the annual town meeting, which will be held soon.

WEST BOYLSTON, MASS.—The Town of West Boylston has entered into a contract with the Marlboro Electric Company, of Marlboro, Mass., for a term of five years, to furnish electricity for lighting the streets of the town. The contract calls for 120 tungsten lamps of 40 cp, at $18 per lamp per year, and to furnish five 40-cp lamps free of charge. The town has the privilege of purchasing the plant at any time by giving six months' notice, the town to pay the actual cost of the plant, plus 10 per cent of the cost of material, and 15 per cent for labor for construction, less 5 per cent for depreciation from July 11, 1911. The company also agrees to furnish electricity for pumping at the rate of 5 cents per kw-hour.

WESTFIELD, MASS.—The Board of Selectmen has voted to make a change in the schedule of rates for electricity to take effect after March 1 as follows: For the first 25 kw, 16 cents per kw-hour; for the next 114 kw, 14 cents per kw-hour; for the next 250 kw, 12 cents per kw-hour, and all in excess of 289 kw, at 10 cents per kw-hour. A reduction of 10 per cent will be allowed on all bills paid on or before the 15th of the month. The new schedule gives a reduction in the rates from 10 to 15 per cent on the old prices.

BAY CITY, MICH.—The Supreme Court has handed down a decision making an injunction restraining the City Council of Bay City from building a municipal electric light plant permanent. The Bay City Traction & Electric Lighting Company sought the injunction, claiming that the Council had no right under the city charter to take action of this kind.

CHEBOYGAN, MICH.—It is reported that the plants and holdings of the Cheboygan Electric Light & Power Company and the Cheboygan Gas Light Company have been purchased by the United Equipment Company, of Chicago, Ill.

DETROIT, MICH.—The Detroit Traction Company has filed a petition with the city clerk to be presented to the Common Council for a franchise to construct several street railways in this city.

DETROIT, MICH.—The Detroit United Railway Company is reported to have placed an order for one 1500-hp steam turbine with the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.

DETROIT, MICH.—Estimates prepared by Frank T. Mistersky, general superintendent of the municipal electric light plant, amounting to $348,248, have been approved by the Board of Estimates and will be submitted to the City Council. For operation and maintenance of the plant, which includes a recommendation for the purchase of equipment for 12-75 flame lamps and changing over the old style Brush lamp, the commission asks for $180,791, by which it will save the city about $6,000. Estimates for extensions and improvements include the erection of a new substation in the northwestern part of the city at a cost of $24,403; conduits on several streets, $21,039; new lamp locations with necessary equipment, $21,419; installation of 400 additional metallic flame arc lamps, $48,000; changing arc lamp system, $47,683; installation of new boilers with equipment, $13,366.

MANISTIQUE, MICH.—The Michigan State Telephone Company will soon commence work on the construction of a new trunk line between Manistique and Trout Lake, a distance of 45 miles.

WEST BRANCH, MICH.—Owing to a disagreement between the Village Council and the Rifle River Electric Light Company, the electric lighting service has been discontinued, leaving the streets of the village in darkness.

ALBANY, MINN.—The City Council has rejected all bids for the installation of a lighting system. Thomas Tomasek is village recorder.

BROWNS VALLEY, MINN.—Plans are being considered to organize a local telephone company and install a telephone system in Browns Valley at a cost of $4,000. The company will be capitalized at $50,000. N. J. Brown is secretary.

CHISHOLM, MINN.—Plans are being made by the local telephone company to install a new plant and also a new system of telephones.

COHASSET, MINN.—Plans are being considered by the local electric light company to increase the output of its plant.

GARNES, MINN.—The construction of a telephone line from Garnes to Malone is under consideration. Ole Riersgaard is interested in the project.

GRACEVILLE, MINN.—The citizens have decided to organize and install an independent telephone exchange at once. A. D. O'Brien was elected president; Frank Valesh, vice-president, and L. J. Keating, secretary.

MINNEAPOLIS, MINN.—The L. S. Donaldson Company has awarded the contract for boilers for the central power plant for the Donaldson buildings to the Fairbanks-Morse Company, of Chicago, Ill. The contract calls for eight boilers at a cost of $30,000.

MIZPAH, MINN.—W. A. Potter has been granted a franchise to construct and operate an electric light plant in this village.

PIPESTONE, MINN.—The Northwestern Telephone Company contemplates rebuilding the Pipestone telephone system and will establish an all-cable plant. M. E. Guinter is local manager.

RED LAKE FALLS, MINN.—The Red Lake Falls Electric Light Company has applied to the City Council for a franchise in this city.

ST. CLOUD, MINN.—Arrangements are being made by the Lunemberg Company to erect a telephone line from St. Cloud to Grand Lake via Pleasant Lake. H. C. Block is president.

STEWARTVILLE, MINN.—It is reported that a company has been formed to take over the plant of the Stewartville Electric Light Company. O. E. Hammer, E. J. Colby and James Anderson are interested in the company.

ROCKPORT, MO.—Plans are being considered to install an electric or gas motor for pumping water in the municipal electric light and water works plant. W. E. Germann is manager.

SPRINGFIELD, MO.—The county court has granted George Norman, G. W. Boyd, J. V. Sweet and others permission to erect a telephone line on the Needmore and Republic roads.

FROMBERG, MONT.—The question of erecting an electric light plant in this place is under consideration.

MISSOULA, MONT.—Arrangements are being made by the Montana Independent Telephone Company to enlarge its telephone system in Missoula.

WHITEFISH, MONT.—The installation of an electric light plant is under consideration here.

BROKEN BOW, NEB.—O. J. Shaw, superintendent of the Aurora Electric Light, Heat & Power Company, of Aurora, Neb., has been making investigations with a view of establishing an electric light plant in Broken Bow.

PAPILLION, NEB.—The question of establishing a lighting plant in Papillion is under consideration.

WYMORE, NEB.—At the next regular election the citizens will vote on the proposition to establish an electric light plant here.

HAWTHORNE, N. J.—The contract for the installation of a complete electric plant in the Wagaraw Bleachery Company, at Hawthorne, has been awarded to the Washington Company, of New York, N. Y. The equipment includes a 375-hp Hamilton Corliss engine, a 100-hp boiler and a large Sprague generator.

HOBOKEN, N. J.—It is reported that the Delaware, Lackawanna & Western Railroad Company is again considering the question of equipping its railway system from Hoboken to or beyond the Oranges, in New Jersey, to be operated by electricity. It is said that if the company can make arrangements with the municipalities of East Orange and other cities in regard to grade crossings, work will commence on equipping the entire Morris and Essex division before 1910.

PATERSON, N. J.—It is reported that the New Jersey Construction Company is making inquiries in the trade for boilers of about 1000 hp, which, it is said, is the initial purchase for a large power plant to furnish electricity for an electric railway. The company is acting for a corporation which secured a charter to build an electric railway from Suffern, N. Y., through Paterson and other towns to Hoboken, N. J., to connect with the McAdoo tunnels at that place. The equipment now called for, it is said, will be used principally in construction work. The company is considering erecting a large power plant in Hackensack, N. J., to supply electricity for operating the railway, but as yet the location has not been decided upon.

HINSDALE, N. H.—A bill has been introduced to the State Legislature by Representative E. B. Poke, of Hinsdale, N. H., asking for an amendment of the charter of the Connecticut River Power Company allowing it to build a second dam below the other, now nearly completed, across the Connecticut River at French King Rapids, near Hinsdale. The dam now under construction will develop about 15,000 hp, and the construction of the second dam would increase it to about 24,000 hp. The cost of the proposed dam is estimated at from $150,000 to $200,000.

MILFORD, N. H.—The town officials are considering the question of operating the pumps in connection with the water-works system by electricity, instead of steam power, which it is estimated would save the town several hundred dollars a year and give the town an all-night electric service.

ROSWELL, N. M.—A petition signed by the business men of the town has been presented to the City Council asking the Council to call an election to vote on the proposition to issue bonds for the construction of a municipal electric light plant.

ADDISON, N. Y.—The Tuscarora Valley Traction Company has applied to the Public Service Commission, Second District, for permission to operate an electric railway between Addison, Woodhull and Jasper, a distance of 19 miles. E. C. Smith and W. E. Barron, of Addison, are interested in the enterprise.

BATAVIA, N. Y.—Plans are being prepared by Rudolph Hering and A. L. Webster, of New York, N. Y., consulting engineers, for the construction of the proposed sewerage disposal plant and pumping station for the city of Batavia, bids for which will soon be called. The equipment of the plant will include one 150-hp engine, a boiler of 150 hp, two motor-driven pumps, one additional pump with lower rating, and manholes, castings, etc. The cost of the plant is estimated at $150,000.

BERGEN, N. Y.—Plans have been completed for the construction of the municipal electric light plant, for which bids will soon be asked.

BINGHAMTON, N. Y.—Mayor Clarence M. Slauson, in his annual message, recommends placing all overhead wires in the city undergrounnd.

HEMPSTEAD, N. Y.—The Public Service Commission, Second District, has approved of the franchise granted to the Nassau Light & Power Company by the village of Hempstead, extending the franchise of the company from Jan. 1, 1907, to Jan. 1, 1927.

HUDSON, N. Y.—The Albany & Hudson Railroad Company has placed an order with the General Electric Company, Schenectady, N. Y., for a 1500-kw steam turbine.

LONG ISLAND CITY, N. Y.—Plans are being made by the Long Island Railroad Company for extensive improvements and extensions to its system during the coming year, which will include equipping the railroad from Ozone Park to the entrance of the tunnel at Long Island City and the railway from Jamaica to Sunnyside yard to be operated by electricity. While the North Shore Division is to be equipped to be operated by electric power, eventually, it is not expected that work will commence on that part of the work before 1910. The railway to Long Beach will be changed from steam to electricity after the more important work is completed.

NEW YORK, N. Y.—It is said that plans of the New York Edison Company for the construction of a central-power station at 201st Street, New York City, will soon materialize. The proposed plant will have an output of about 20,000 hp, which will include 30 boilers of 600 hp each. It is stated that the company proposes to follow the layout of the new addition to the Waterside station, which was completed about a year ago.

NEW YORK, N. Y.—Bids will be received by John W. Brannan, president of the board of trustees, Bellevue and Allied Hospitals, Twenty-sixth Street and First Avenue, New York, N. Y., until Feb. 16, for furnishing and setting lighting fixtures in training school for women nurses of Bellevue and Allied Hospitals. Blank forms may be obtained at the office of the contract clerk, 419 East Twenty-sixth Street, New York, N. Y., where bids and deposits are to be delivered.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is said to have placed orders with the Westinghouse Electric & Manufacturing Company for three new 1000-kw, 60,000-volt, stepdown transformers to be placed in Station No. 33 in Elmwood Avenue. These transformers will be used to reduce the voltage from Niagara Falls from 66,000 to 550 to be transmitted by underground cable to operate the street car lines in the city. The station already has an output of about 6000 kw.

ROCHESTER, N. Y.—Plans and specifications for the new factory building of L. Adler Brothers Company, of Rochester, N. Y., are being prepared by Charles A. Alexander, Builders' Exchange, Rochester, N. Y., consulting engineer. The equipment of the plant will include four boiler units with a total rating of 800 hp, two 150-hp automatic engines and two 100-kw generators direct connected, boiler feed and circulating pumps, motors, blowers and other accessories. The company has awarded a contract to the Ferro-Concrete Construction Company for the construction of its factory building.

SYRACUSE, N. Y.—The Rochester, Syracuse & Eastern Railroad Company has decided upon the route for its proposed extension to Rochester, work on construction of which will begin as soon as the weather will permit. The railway will be 25 miles in length and will extend from Port Bryan via Weedsport, Jordan, Memphis and Warner. C. D. Beebe is president.

SYRACUSE, N. Y.—The Central City Refrigerating Company is erecting a large cold storage and electric plant at West Fayette and West Streets, Syracuse. Bids will be received by R. S. M. Mitchell, Kirk Building, Syracuse, N. Y., consulting engineer, for the following equipment: Four gas producer units, with a rating of 250-hp each; two 500-hp gas engines for direct connection to generators; two 300-kw generators, direct connected type; two 200-ton direct motor driven vertical single-acting refrigerating machines; one circular or spiral conveyor; seven freight and one passenger elevators and motor-driven ventilating apparatus.

VALLEY FALLS, N. Y.—The village Trustees are considering the question of replacing the present street lamps with electric lamps. It is proposed to secure electricity from the General Electric Company.

COLUMBUS, OHIO.—Plans are being made by the Findlay-Marion Railway & Light Company to commence work on its proposed electric railway in April, which is to connect Findlay, Mount Blanchard, Forest, Marseilles, Meeker and Marion, a distance of 46 miles. The company expects to purchase 12 cars and has already placed a contract for electricity for operating the railway. G. W. Meeker, of Columbus, Ohio, is secretary and treasurer.

COLUMBUS, OHIO.—The City Council now has before it an ordinance making a maximum rate of 5 cents per kw-hour for electricity for commercial lighting. The committee on gas and electric lighting has postponed action on the ordinance until officers of the local company have an opportunity to consider the matter. General Manager E. K. Stewart stated that the company would be willing to make a reduction of 20 per cent from the maximum rate of 8 cents per kw-hour if bills were paid by a certain date. This would make the rate 6.4 cents for those cases, and it is believed the company would be willing to compromise on 6 cents rather than to enter into litigation, such as resulted when the City Council endeavored to establish a 5-cent rate. The courts decided in favor of the company at that time.

CUYAHOGA FALLS, OHIO.—The installation of a new boiler and fire room outfit for the municipal electric light plant is under consideration. C. D. Crumb is city clerk.

RICHWOOD, OHIO.—The York Telephone Company, of York, Ohio, contemplates the construction of a trunk telephone line from Byhalia to York, Raymond, Liberty and West Mansfield, a distance of about 30 miles.

KENMORE, OHIO.—The Village Council has granted a franchise to the Turkeyfoot Traction Company to extend its railway into the village.

SOMERSET, OHIO.—The City Council has granted a franchise to the Independent Telephone Company to operate its system in Somerset. The Independent company has taken over the plant of the Union Telephone Company, of Glouster, and will greatly improve and extend the system during the coming summer.

TIFFIN, OHIO.—In the report of J. W. Harbaugh, receiver of the Consolidated Gas & Light Company, submitted to Judge R. W. Taylor, of the Federal Court, he recommends that the electric plant be sold and the gas plant operated separately. According to the report the electric plant is bonded for $50,000 and the gas plant for $125,000, of which $103,500 are still outstanding. Mr. Harbaugh also states that the electric plant is in bad condition and will require an expenditure of $15,000 to replace worn out equipment.

TOLEDO, OHIO.—The armature of one of the 3000-kw steam turbines in the power plant of the Toledo Railways & Light Company was recently burned out.

TOLEDO, OHIO.—Announcement has been made by the Ohio & Michigan Southern Railroad Company that it proposes to construct an electric railway from Toledo to Ann Arbor and an extension from Petersburg to Jackson. Trains are in operation from Toledo, Ohio, to Petersburg, and grading has been finished from Petersburg to Ann Arbor. The company expects to build the section from Petersburg to Jackson as soon as the weather permits. W. E. Niles, 122 Monroe Street, Chicago, Ill., is secretary.

YELLOW SPRINGS, OHIO.—The City Council is considering the question of improving the street lighting system.

ANADARKO, OKLA.—The citizens have voted to issue $14,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant.

HOBART, OKLA.—It is reported that the Hobart Water Power Company, recently incorporated, is planning to construct a hydro-electric plant with an output of 7500 hp to furnish electricity to operate the proposed Hobart Interurban Railway, and for lamps and motors along the route of the railway. Plans will be completed in about 90 days and construction work, it is said, will begin about April 15. C. T. Blake is president.

MUSKOGEE, OKLA.—Plans are being made by the Pioneer Telephone & Telegraph Company to improve and extend its local telephone system, which will involve an expenditure of about $100,000.

OKLAHOMA CITY, OKLA.—The Oklahoma Railway Company is in the market for coal and ash-handling apparatus for its power plant.

POND CREEK, OKLA.—The city has purchased the electric plant recently installed by Mathis & Company, which was recently sold at a sheriff's sale. The city will complete the system, securing power from the pumping station east of the river. The plant will be operated by the municipality.

EUGENE, ORE.—The Lane County Commissioners have granted the Lane County Asset Company a franchise to construct an electric railway over the county roads from Eugene to Florence on the Lane County coast. Alton Hampton, F. E. Dunn, C. H. Fisher, Fred Fisk and others are interested in the project.

HOOD RIVER, ORE.—An election will be held March 25 to vote on the proposition to issue $200,000 in bonds for the construction of a light plant and water works system.

NEWBERG, ORE.—The Yamhill Electric Company contemplates installing two new boilers in its plant. C. J. Edwards is president and manager.

PORTLAND, ORE.—We are informed that the Portland Water Power & Electric Company will let contracts for water wheels, generators and

all electrical equipment and steel penstock in connection with its proposed plant to be erected on Clackamas River, near Estacada. George I. Brown, Chamber of Commerce Building, Portland, Ore., is engineer.

WATERLOO, ORE.—J. B. Lethwaite has acquired water rights on the South Santiam River and will erect a power plant at Waterloo six miles from Lebanon to furnish electricity to operate the paper mill there.

JOHNSTOWN, PA.—The Johnstown & Gallitzin Railway Company is ready to receive bids for material to be used in the construction of its proposed electric interurban railway from Johnstown to Gallitzin. About 36 miles of single track will be built, and will include special track work, wooden poles, overhead construction, catenary form being considered for the stretches between incorporated towns, the road being entirely on private right of way except through small towns. Also for equipment for steam power plant to include two generating units of 750 kw each to generate electricity at 13,000 volts. One substation will be located at the power station, and an additional substation at each end of the line. Electricity will be transformed to 600 volts, direct current, as the company proposes to operate cars for a distance of 2¼ miles over the Johnstown Passenger Railway Company's tracks.

MEDIA, PA.—The Philadelphia & West Chester Traction Company has applied to the City Council for a franchise for a right of way over several streets in this city. It is said that the company intends to make Media a terminus of a railway running from State Street, across the townships of Nether Providence, Marple, Springfield and Upper Darby and make connections with the elevated road in Philadelphia. It is also stated that the company proposes to extend the railway westward through Media, Lima and Gradyville, connecting with the main line on the West Chester Pike in Edgmont.

PHILADELPHIA, PA.—The Western Union Telegraph Company has decided to place its wires underground on Samson Street from Sixth to Sixteenth Street.

PHILADELPHIA, PA.—The contract for the electrical equipment and power plant in the William Penn Theatre at Lancaster and Fairmount Avenues has been awarded to Joseph S. Miller & Company, of Philadelphia.

PITTSBURG, PA.—The Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., has been awarded the contract for furnishing a 5000-kw generator for the Brunos Island power plant of the Pittsburg Railways Company. The contract for furnishing and installing all steam and exhaust piping in connection with this generator has been awarded to the Pittsburg Valve, Foundry & Construction Company, of Pittsburg, Pa.

READING, PA.—Application has been made to the City Council by the Penn Electric Company for a franchise to construct underground conduits and erect overhead transmission lines for the distribution of electricity for lamps in the city.

READING, PA.—The Reading Edison Company has applied to the City Council for a franchise to construct and operate an electric light plant. Should the franchise be granted the company agrees to turn the entire plant over to the city at its option at any time after 1920 at a price to be agreed upon between the two parties.

WESTERLY, R. I.—The Westerly Light & Power Company will soon commence work on the erection of its transmission lines from Westerly to Potter Hill and Ashaway to furnish electricity for lamps and motors.

EASLEY, S. C.—Plans are being considered for the installation of electrical equipment in the Easley Oil Mills to supply electricity for about 1000 incandescent and 15 arc lamps. For further information, address P. Camp Johnson, superintendent.

HURON, S. D.—The City Council has granted a franchise to F. H. Kent, C. T. Koepp, William Waibel and others to construct and operate a telephone system in Huron.

ROCKFORD, TENN.—The Rockford Cotton Mills, of which Ernest Koella, 2326 Highland Avenue, Knoxville, Tenn., is manager, is making arrangements to rebuild the electric plant, recently destroyed by fire. The plant will be operated by water power and will furnish electricity to light the mill and town.

ORANGE, TEX.—The Southwestern Telegraph & Telephone Company contemplates an expenditure of from $12,000 to $15,000 for improvements to its local system. J. E. Farnsworth, of Dallas, Tex., is vice-president and general manager.

SALT LAKE CITY, UTAH.—The City Council has authorized the Board of Public Works to advertise for bids for the construction of the west side conduit, to extend from Fourth West Street to the Jordan River.

FREDERICKSBURG, VA.—The Electric Generating Company and the Fredericksburg Electric Company have applied to the City Council for a franchise to distribute electricity within the city limits. The first named company proposes to sell electrical energy in large quantities only, and the last named company to supply electricity for lamps and motors to the general public.

MEHERRIN, VA.—Arrangements are being made by the Lunenburg Telephone Company for improvements to its central offices and to construct two or three extensions to its lines.

HIGHLAND PARK (P. O. RICHMOND), VA.—The town of Highland Park is open for bids for a 25-year charter to furnish electricity for lamps. For further information address W. P. Redd, mayor.

ABERDEEN, WASH.—Plans are being made by the property owners on Market and Webster streets to install an ornamental system of electric lamps similar to the ones now in use on Huron Street.

DAYTON, WASH.—The City Council is considering the proposition to purchase the plant and holdings of the Dayton Electric Company, to be operated by the municipality at a cost of $75,000. The Dayton ice plant is to be included in the purchase.

EDMONDS, WASH.—The plant of the Edmonds Electric Light & Power Company is nearly completed and is now furnishing electricity for lighting the streets of the town. The company will soon be ready to furnish residential lighting and for motors for local industries.

NORTH YAKIMA, WASH.—The Yakima Valley Power Company is erecting a 66,000-volt transmission line between North Yakima and Kennewick, 90 miles in length, and expects to increase the output of its plant in North Yakima by 4,000-hp. The company will furnish electricity in Wapato, Granger, Sunnyside, Grandview, Mabton, Kiona and Kennewick. G. C. Arrowsmith is general superintendent.

PULLMAN, WASH.—Several parties are installing electric light plants operated by a gasoline engine. B. F. Campbell is now installing one, and several others contemplate installing plants.

TUKWILA, WASH.—The International Contract Company, of Seattle, Wash., contemplates furnishing this town with electricity for lamps.

CHARLESTOWN, W. VA.—The Winchester & Washington City Railway Company has applied to the County Court of Jefferson County for permission to erect transmission lines along the public road from Charlestown to Shenandoah Junction, thence to Bardane and Kearneysville.

FAIRMOUNT, W. VA.—The Independent Light & Power Company has applied to the City Council for a franchise to operate in Fairmount. If granted a franchise the company agrees to have the plant in operation within 17 months after the franchise is granted.

FOLLANSBEE, W. VA.—Plans are being considered by the Citizens' Water & Light Company to install a water works system, for which application will soon be made to the City Council for a franchise to operate the same. Charles Crawford, of Follansbee, is president.

APPLETON, WIS.—It is reported that the Wisconsin Telephone Company contemplates rebuilding the local exchange at a cost of $75,000.

CHIPPEWA FALLS, WIS.—The Chippewa & Flambeau Improvement Company, recently organized, has applied to the State Legislature asking for power to contract, acquire and operate a system of water reservoirs and dams on the principal streams of northwestern Wisconsin.

ELLSWORTH, WIS.—The Pierce County Telephone Company has filed an amendment to its charter increasing its capital stock from $50,000 to $100,000.

LA CROSSE, WIS.—The La Crosse Toll Line Company, it is said, contemplates the construction of a toll line from La Crosse to Viroqua. The company is capitalized at $40,000.

LA CROSSE, WIS.—Owing to the refusal of the City Council of Winona to grant a 50-year franchise, the La Crosse Water Power Company, which controls the Winona Railway & Light Company, has announced that it will not build an interurban railway from Winona to Lanesboro, Rushford and other southern Minnesota cities.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has purchased the plant and holdings of the Walworth County Independent Telephone Company, which was recently placed in the hands of a receiver.

MILWAUKEE, WIS.—Extensive improvements have been outlined by the Wisconsin Telephone Company to its system in this State, which will involve an expenditure of about $1,000,000. The company has recently purchased the plants and holdings of the Northwestern Telephone Company and the Douglass County Telephone Company.

MONROE, WIS.—The Monroe Telephone Company is planning to make improvements to its system.

THERMOPOLIS, WYO.—The Hot Springs Light & Power Company is contemplating extending its transmission lines from Thermopolis to Anchor. M. W. Thompson is manager.

LETHBRIDGE, ALB., CAN.—Bids will be received until March 1 by George W. Robinson, secretary and treasurer, for the construction of a municipal electric power plant in Lethbridge, including boilers and accessories, economizer, feed pumps, mechanical draft, pipe work and valves, steam-driven generator, tubro-generator, re-erection of steam engines, condensing sets, crane, switchboards, etc., motor generators, transformers, building steel work, etc. Plans and specifications can be seen at the office of Smith, Kerry & Chace, Confederation Life Building, Toronto, Ont., consulting engineers, and at the Carnegie Public Library Building, Winnipeg, Man. A deposit of $10 will be required for use of plans and specifications, which will be returned when contracts are awarded.

NEW WESTMINSTER, B. C., CAN.—Plans are being prepared by the British Columbia Electric Railway Company to construct a tramway from Westminster Junction to Coquitlam Lake, a distance of about seven miles.

WINNIPEG, MAN., CAN.—Bids will be received by the chairman of the Board of Control, Winnipeg, Man., Can., until March 2 for the supply of insulators and material for the erection of a telephone line between Point du Bois and Winnipeg; the erection of a transmission line between Point du Bois and Winnipeg, and supply of certain repair-shop equipment. Individual bids will also be received as follows: For insulators; telephone line; erection of transmission line; repair-shop equip-

ment. As a further alternative bidders may include or group the bids for furnishing the telephone line and erection of transmission line. Copies of instruction to bidders and form of tender may be obtained at the office of the power engineer, Carnegie Library Building, Winnipeg, Man., Can. Plans and specifications may be seen at the office of Smith, Kerry & Chace, Confederation Life Building, Toronto, Ont., Can., consulting engineers. M. Peterson is secretary.

CAMPBELLFORD, ONT., CAN.—The Seymour Power & Electric Company is making arrangements for the construction of a power house at Seymour, Ont. The power plant will have an output of 4000 hp when completed. Contracts have already been placed for the more important machinery. Smith, Kerry & Chace, Toronto, Ont., are engineers in charge of the construction work of the plant.

TORONTO, ONT., CAN.—The People's Railway Company is planning to commence work on the construction of its proposed electric railway in April. The railway will be 88 miles in length and will connect Stratford, Berlin, Guelph and Woodstock. Electricity for operating the road will be purchased from the Hydro-Electric Commission. The company will be capitalized at $1,000,000. Among the provisional directors are: N. R. Bugg, Bright, Ont.; W. A. Bugg, Joseph McNeil, A. N. Warfield and J. H. Wood, of Toronto, Ont. R. T. Gough, of Toronto, chief engineer.

ACAYUCAN, MEX.—The water fall of Salto de Huasuntian, situated near the Town of Acayucan, State of Vera Cruz, is to be utilized for generating electric power. Jose Castellot is at the head of a company which is arranging to install a hydro-electric plant at that point.

AGUASCALIENTES, MEX.—The Cia. De Luz Fuerza Electricas De Aguascalientes, S. A., is contemplating the installation of two Deisel oil engines with a rating of 250 and 500 hp. C. P. Doerr is manager.

SAN ISIDRO, MEX.—Salvador Echegaray is at the head of a syndicate of Mexicans who have taken steps to erect a hydro-electric plant on the Lerma River in the State of Michoacan, near the hacienda San Isidro.

SAN JUAN DEL RIO, MEX.—The Compania de Luz y Fuerza Motriz, of San Juan del Rio, State of Queretaro, will install a hydro-electric plant on the San Juan River. The company has obtained a concession from the Federal Government for the proposed enterprise.

TECAMACHALCO, MEX.—A new electric light and power plant is being erected at Tecamachalco, State of Puebla, by Jesus G. Ruinard and associates.

TORREON, MEX.—The new electric plant of the Torreon a' Lerdo Electric Light & Power Company is nearly completed and will soon be put in operation. The company proposes to furnish electricity for lamps and motors in Lerdo, Gomez, Palacio and Torreon.

VILLA CORONA, MEX.—David John Pullinger, of Villa Corona, State of Durango, has taken steps to install a hydro-electric plant on La Presa River.

Company Elections.

SIOUX CITY, IA.—At the annual meeting of the Sioux City & Spirit Lake Interurban Company the following officers were elected: Frank Patch, president; William H. Beck, vice-president; Fred Davis, secretary; T. A. Black, treasurer, and J. D. Browning, general manager.

AUGUSTA, MAINE.—At the annual meeting of the Kennebec Light & Heat Company the following-named officers were elected: George F. West, of Portland, Maine, president; Samuel C. Manley, of Augusta, Maine, treasurer and clerk, and William H. Williams, of Augusta, Maine. superintendent.

AMHERST, MASS.—At the annual meeting of the Connecticut River Power Company the following-named officers were elected: C. Fred Deuel, president; Philip Cabot, treasurer, and C. W. Hazelton, of Turners Falls, Mass., clerk. The board of directors includes the above officers and Henry F. Thompson, of Boston, Mass.; E. D. Marsh and M. A. Dickinson, both of Amherst, Mass.

GREENFIELD, MASS.—At the annual meeting of the Greenfield Electric Light & Power Company the following directors were elected: J. W. Stevens, F. O. Wells, C. C. Dyer, W. B. Allen, Philip Cabot and Winthrop Coffin, of Boston, Mass., and J. G. MacIntosh, of Holyoke, Mass. The directors elected G. W. Lawrence, treasurer, and C. H. Keith, clerk.

WESTFIELD, MASS.—At the annual meeting of the Westfield Power Company the following-named officers were elected: M. B. Whitney, president; Sumner B. Campbell, clerk and treasurer, and George Dunbar, superintendent.

ST. LOUIS, MO.—The United Railways Company at its annual meeting re-elected the old directors with the exception of Charles D. Smithers and George R. Sheldon, whose places were filled by A. D. Brown and D. R. Francis, Jr., of St. Louis, Mo.

SODUS, N. Y.—At the annual meeting of the Sodus Gas & Electric Light Company the following-named officers were elected: C. W. Mills, president; Thomas H. Munro, of Camillus, N. Y., vice-president; A. E. Larkin, of Syracuse, N. Y., treasurer, and G. R. Mills, secretary and general manager.

PHILADELPHIA, PA.—At the annual meeting of the American Gas & Electric Company the old board of directors was elected with the exception of R. T. Paine. W. T. Hanson was elected to succeed Mr. Paine.

SHAMOKIN, PA.—At the annual meeting of the Shamokin & Coal Township Light Company the following-named directors were elected: E. M. Leader, K. C. McWilliams, F. P. Llewellyn, M. G. Stief, J. W. Gillespie, M. C. Farrow, S. L. Sowres, Warren Unger, H. S. Zimmerman, C. C. Leader, George C. Greaber, John Mullen and W. C. McConnell. The directors elected the following officers: E. M. Leader, president; K. C. McWilliams, vice-president; F. P. Llewellyn, secretary and treasurer.

PROVIDENCE, R. I.—At the annual meeting of the Narragansett Electric Light Company the following named officers were elected: Arthur L. Kelly, president; Arthur H. Watson, vice-president; Edwin A. Barrows, secretary and treasurer; Arthur B. Lisle, general manager; William C. Woodward, electrical engineer, and Wesley T. Oviatt, general superintendent.

New Industrial Companies.

THE FAYETTE ELECTRICAL COMPANY, of Boise, Idaho, has been incorporated, with a capital stock of $50,000, by R. C. Carter, Jesse Hawley and Charles W. Mack.

THE SCENIC ELECTRIC MANUFACTURING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, by William B. Ribbett and others.

THE ELECTRICAL SALES COMPANY, of Jersey City, N. J., has been incorporated, with a capital stock of $2,000, by Harold B. Elgar, Walter Cook, Jr., and Albert C. Wall, of Jersey City, N. J.

THE STANDARD IGNITION COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $2,500, by F. J. Casey, George L. Fish and A. A. McClanahan. The company proposes to manufacture electrical devices.

THE BUTLER ELECTRIC EQUIPMENT COMPANY, of Hamilton, Ohio, has been incorporated, with a capital stock of $10,000, by Paul M. Hooven, G. G. Schoenberger, Bert Seevers, Vincent J. Bramlage and A. P. Darrow.

THE LUDWIG-KAWIN COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $2,500, by George R. Ludwig, Charles C. Kawin and Charles Goetz. The company proposes to carry on a business as chemists and engineers.

THE TRACTION DEVELOPMENT CORPORATION, of Jersey City, N. J., has filed articles of incorporation with the Secretary of State, with a capital stock of $100,000. The incorporators are H. O. Coughlan, B. S. Mantz and John R. Turner.

THE WATER POWER DEVELOPMENT COMPANY, of Boston, Mass., has been chartered, with a capital stock of $50,000, for the purpose of dealing in water power devices of all kinds. R. F. Berry, of Boston, Mass., is president and treasurer.

CRUISE & COMPANY, of Elizabeth, N. J., has filed articles with the Secretary of State, with a capital stock of $50,000, to manufacture boilers and tubes. The incorporators are Alex Cruise, Frederick Sommer and Martin F. Kennely, all of Elizabeth, N. J.

LEVETT MANUFACTURING COMPANY, of Matawan, N. J., has been chartered, with a capital stock of $300,000, to manufacture electric dynamos, motors, batteries and electric appliances, by Roderic Wellmann, J. Cotter and S. Likely, all of Matawan, N. J.

THE BAY RIDGE CHANDELIER COMPANY, of Brooklyn, N. Y., has been chartered, with a capital stock of $2,000, by Joseph and Ella Moskowitz Morris and R. Popkin, all of Brooklyn, N. Y. The company proposes to manufacture and deal in gas and electric fixtures.

THE FRUITTICHER ELECTRICAL COMPANY, of Birmingham, Ala., has been incorporated, with a capital stock of $10,000, and the following-named officers: W. H. Fruitticher, president; George A. Leath, vice-president, and E. W. Fruitticher, secretary and treasurer.

THE VALLEY BOAT & ENGINE COMPANY, of Baldwinsville, N. Y., has been incorporated, with a capital stock of $20,000, to manufacture gasoline motors, engines, electric motors, etc., by Dwight S. Simpson, Rees H. Hubbell, Josiah Tallmadge, of Baldwinsville, N. Y.

THE WATERTOWN AUXILIARY FIRE-ALARM COMPANY, of Watertown, N. Y., has been incorporated, with a capital stock of $40,000, to construct fire-alarm systems. The incorporators are John I. Mange, Warren J. Green and Sanford J. Magee, all of Watertown, N. Y.

THE LOXIT MOTOR-LOCK COMPANY, of North Tonawanda, N. Y., has been chartered, with a capital stock of $30,000, by Pemberton Lundy, Samuel J. Elliott and George W. Fowler, all of North Tonawanda, N. Y. The company proposes to manufacture gas and steam engines, etc.

HARRY L. GRAFF, INC., of New York, N. Y., has filed articles of incorporation, with a capital stock of $4,000, to manufacture machinery, motors and vehicles. The incorporators are: Harry L. Graff and Levi A. Graff, of Bensonhurst, N. Y., and Charles J. Flynn, of New York, N. Y.

THE PEEKSKILL ENGINEERING COMPANY, of Peekskill, N. Y., has been incorporated, with a capital stock of $10,000, by William A. Blepoch, Malcolm F. Lent and William H. Lent, all of Peekskill, N. Y. The company proposes to carry on a civil engineering and construction business.

THE WEAVER ELECTRIC COMPANY, of Johnson City, Tenn., has been incorporated, with a capital stock of $1,500, to do a general contracting business and deal in electrical supplies. The officers of the company are: M. S. Weaver, president and general manager, and John R. Weaver, secretary.

THE STANDARD LEGNETTO COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $6,000. The incorporators are Patrick H. McNulty, Jacob M. Krafff and Charles M. Henunway, all of New York, N. Y. The company proposes to deal in gas and electric fixtures.

THE VERNON MOTOR COMPANY, of Vernon, N. J., has filed articles of incorporation, with a capital stock of $25,000, for the purpose of manufacturing gasoline, electric and other types of motors, automobiles, etc. The incorporators are William H. Carey, Charles J. Gormley, John H. Patterson, all of Jersey City, N. J.

THE ADVERTISING MIRRORGRAPH COMPANY, of Brooklyn, N. Y., has filed articles of incorporation, with a capital stock of $28,000, for the purpose of doing general electrical work, manufacturing signs, mechanical displays, etc. The incorporators are C. K. Allen, E. L. Hopkins, C. J. Hermance, of New York, N. Y.

THE ELECTRIC-AIR DRILL COMPANY, of Camden, N. J., has filed articles of incorporation, with a capital stock of $200,000, to manufacture compressed-air tools, drills and other compressed-air machinery. The incorporators are Charles H. Haesseler, Frank W. Chattin, Joseph V. Little, William J. MacFarland and John F. Joline, of Camden, N. J.

New Incorporations.

FALLS RIVER MILLS, CAL.—Articles of incorporation have been filed for the Lava Bed Power Company, with a capital stock of $2,000,000, and the following-named directors: R. Cadwallader, Roderick McArthur and Frank McArthur. The company proposes to develop the water power on Pitt River, near Fall River Mills, utilizing water from Fall River.

OAKLAND, CAL.—Articles of incorporation have been filed for the Central Oakland Light & Power Company, with a capital stock of $1,250,000. The directors are: A. M. Hunt, of Berkeley, Cal.; James Fisher, of Berkeley, Cal.; James K. Moffitt, of Oakland, Cal.; Mountford S. Wilson, M. D. Levinson, C N. Beal and F. G. Cartwright, all of San Francisco, Cal.

WILMINGTON, DEL.—The Beacon Lighting Company has been incorporated, with a capital stock of $200,000, by E. L. Squire, G. W. Dorsey, Jr., and Albert Biro, of Wilmington, Del.

ATLANTA, GA.—Application has been made for a charter for the Empire Electric Company, with a capital stock of $1,000, by G. G. and J. T. Rucker, H. H. Colquitt and J. T. Warner.

HONOLULU, HAWAII.—The Pearl Harbor Traction Company has applied for a charter with a capital stock of $100,000. The company is a subsidiary of the Honolulu Rapid Transit Company and has been formed to extend the railway system of the traction company to the naval station at Paulua, Pearl Harbor. The officers of the company are: L. Tenney Peck, president; Alfred L. Castle, secretary, and Charles H. Atherton, treasurer.

BOISE, IDAHO.—Articles of incorporation have been filed for the Idaho Southern Railroad Company, with a capital stock of $2,000,000. The company proposes to take over the interests of the North Side Railroad line, which is constructing an electric railway on the Twin Falls tract. It is expected that the railway will be extended to Boise in the near future.

NEWCASTLE, IND.—The Newcastle Union Railway Company has been organized, with a capital stock of $50,000, to construct an electric railway between Newcastle, Sulphur Springs, Honey Creek and Middletown. A local system will be built in Newcastle, and at Middletown connections will be made with the Union Traction Company's system. The officers are: Thomas B. Milikan, president; Charles W. Mouch, vice-president, and Albert D. Ogborn, secretary.

FARMINGTON, KY.—The Farmington Telephone Company has been chartered, with a capital stock of $5,000, by J. C. Skelton, J. J. Trumbo and D. C. Turner.

LITTLE CYPRESS, KY.—The Little Cypress Telephone Company has been incorporated, with a capital stock of $2,000, by E. R. Goodloe, R. L. Holland and R. M. Jones.

HOUGHTON, MICH.—The Northern Michigan Power Company has been chartered with a capital stock of $50,000 by D. L. Robinson and others. The company proposes to dam the Sturgeon River, the power to be utilized to generate electricity which will be transmited to Baraga, Houghton, Ontonagon, Marquette, Dickinson, Iron and Gogebic Counties. The company also proposes to furnish water power.

MANISTEE, MICH.—The Manistee County Electric Company has been chartered to develop the water power on Manistee River, about 18 miles from Manistee. The officers are: E. N. Salling, president; R. W. Smith, vice-president; Clyde J. Holmes, secretary and treasurer.

NORTHVILLE, MICH.—The Inter-County Telephone Company has been incorporated with a capital stock of $5,000 by Clement C. Yerkes, Louis A. Babbitt, Robert C. Yerkes and Frank Thompson.

FERGUS FALLS, MINN.—The Edwards Telephone Company has been incorporated to construct a telephone system north of this city. E. W. Leeper is secretary and treasurer.

GRANGER, MINN.—A new telephone company has been organized under the name of the North Branch of the Granger Telephone System and the following named officers elected: A. N. Brant, president, and W. Henry, secretary.

STACY, MINN.—The Stacy Telephone Company has been incorporated, with a capital stock of $5,000, by C. O. Anderson, A. J. Levander, W. H. Eastman, H. E. Shorracks, H. C. Keacher, John Allquist and Sanford C. Broadbent, all of Sanford.

CHARLESTON, MISS.—The Charleston Electric Light & Power Company has been organized with a capital stock of $5,000 for the purpose of installing an electric light plant in Charleston. The cost of the plant is estimated at about $10,000. It is proposed to secure electricity for operating the plant from the mill.

LITTLETON, N. H.—The Littleton Telephone Company has been organized and has filed a certificate of incorporation, with a capital stock of $5,000. The officers of the company are: George A. Edson, president; Frank P. Bond, vice-president, and I. N. Lunderville, secretary.

WATERTOWN, N. Y.—The Black River Power Association of Watertown has been incorporated, with a capital stock of $5,000. The directors are: David M. Anderson, Foster P. Rhines, Wooster O. Ball, Elon R. Brown, all of Watertown, N. Y.; C. H. P. Gould, of Lyon Falls, N. Y.; James P. Lewis, of Beaver Falls, N. Y., and James A. Outterson, of Carthage, N. Y.

WATERTOWN, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Deer River Power Company by Stephen R. Cleveland, L. B. Cleveland and George H. Cobb, of Watertown, N. Y. The company is capitalized at $50,000, and proposes to generate electricity for lamps, heat and motors.

COOLEEMEE, N. C.—Articles of incorporation have been filed for the Cooleemee Telephone Company, with a capital stock of $10,000, by J. M. Ledford, J. A. J. Rice and others.

GRAND FORKS, N. D.—The Grand Forks Street Railway Company has been formed, with a capital stock of $250,000, and the following-named officers: R. B. Griffith, president; J. D. Bacon, vice-president; O. A. Webster, secretary, and D. H. Beecher, treasurer, all of Grand Forks, N. D. The company, it is said, contemplates the purchase of the railway owned by the Grand Forks Transit Company, which extends from the center of the city to the State University.

INKSTER, N. D.—The Parker Telephone Company has been incorporated, with a capital stock of $50,000, by M. L. Dryburgh, Angus Johnson, of Medford, N. D., and J. R. Barry, of Inkster, N. D.

CLEVELAND, OHIO.—The Lannert Electric Company has been incorporated, with a capital stock of $3,000, by J. A. Lannert, M. Lannert, E. H. Dill, J. F. Thompson and R. V. Dill.

CACHE, OKLA.—Articles of incorporation have been filed for the Washita Valley Telephone Company, with a capital stock of $2,000. The directors are: W. K. Miller, N. E. Lake and C. E. Hankall, all of Cache.

OKLAHOMA CITY, OKLA.—The Hodge-Scott Electric Company has been incorporated, with a capital stock of $3,000, by D. L. Hodge and D. L. Scott, of Oklahoma City, and D. A. Scott, of Hobart, Okla.

RUSK, OKLA.—The Rusk Telephone Company has been chartered, with a capital stock of $10,000, by J. A. Carver, W. T. Ruby, G. W. Rankin and others.

WOODWARD, OKLA.—The Pleasant Hill Farmers' Mutual Telephone Company has been incorporated by George W. Tannahill and Flay Tibbetts, both of Curtis, Okla.

OREGON CITY, ORE.—The Clackamas Power & Irrigation Company has filed articles of incorporation, with a capital stock of $15,000. The company proposes to construct and operate water systems, reservoirs, etc., to supply water for public, agriculture, mining purposes, etc.; also to establish and operate electrical systems. The incorporators are Bruce C. Curry, H. W. Hagerman, Adrian McCalman, Joseph G. Mumpower and Louise Follansbee.

PORTLAND, ORE.—The Portland, Baker City & Butte Electric Railroad Company has filed articles of incorporation with a capital stock of $2,000,000 for the purpose of constructing an electric railway from Portland to Baker City, across Idaho and Montana to Butte.

READING, PA.—The Inter-City Electric Railway Company has been organized, with a capital stock of $500,000, to construct an electric railway from Reading to Allentown, via Lyons and Tipton, 35 miles in length. The officers are: Maxwell H. Bochow, president; Josiah Fisher, secretary, and Bateman Saddington, treasurer.

PORT LAVACA, TEX.—The Port Lavaca Telephone Company has been incorporated, with a capital stock of $20,000, by W. C. Best, H. C. Innis and Willett Wilson.

TRIMBLE, TEX.—Articles of incorporation have been filed with the Secretary of State for the Trimble Telephone Company by R. V. Thomas, J. M. McKennon, T. A. Pierce, R. O. Fisher and J. H. Green.

FREDERICKSBURG, VA.—The Electric Generating Company has been chartered, with a capital stock of $100,000, for the purpose of selling electricity at its own switchboard in large quantities only. The officers of the company are: E. J. Smith, president; Alvin T. Embrey, secretary and treasurer.

FRONT ROYAL, VA.—The Liberty Corner Mutual Telephone Company has been incorporated, with a capital stock of $5,000 and the following named officers: R. J. Stokes, president; John Derflinger, vice-president, and C. E. Brown, secretary.

CHEHALIS, WASH.—The Twin City Light & Power Company has been incorporated, with a capital stock of $400,000, for the purpose of constructing an electric railway in and between Chehalis and Centralia, also to furnish electricity for lamps and motors. The new company, it is said,

has taken over the electric lighting plants in the two cities. The directors are: H. C. Coffman, of Chehalis, Wash.; Theodore, Hess, of Centralia, Wash.; A. Welch. E. W. Hull and E. W. Harding, of Portland, Ore.

APPLETON, WIS.—Articles of incorporation have been filed for the Wolf River Improvement Company by Frank J. Sensenbrenner, of Neenah, Wis.; John M. Baer, of Appleton, Wis., and William Van Nortwick, of Appleton, Wis. The company has been organized to conserve the flood waters of the Wolf River and thus furnish the Fox and Wolf Rivers with a normal flow of water the year around. It is proposed to construct a large reservoir, dams, etc., on the upper Wolf River in Langlade County, covering about 12 miles.

BARNEVELD, WIS.—The Barneveld & Hollanddale Telephone Company has been chartered, with a capital stock of $1,250, by O. L. Theobald and others.

Personal.

MR. MORRIS W. STROUD, president of the American Gas Company, of Philadelphia, Pa., has been elected a director of the American Railways Company, of Philadelphia, Pa.

MR. ARTHUR V. WAINWRIGHT, formerly with the Mohawk Gas Company, of Schenectady, N. Y., has accepted a position with the Susquehanna Railway, Lighting & Power Company. Mr. Wainwright will have charge of extending and increasing the business of the company.

WATSON & BOYDEN.—Messrs. Robert Watson and J. Hanson Boyden have formed a partnership under the above name, at Washington, D. C., with offices in the National Union Building, for patent practice. Mr. Watson, who is well known in the electrical field, has been practicing as a solicitor and counsel for the past 15 years. Mr. Boyden was for five years a member of the U. S. Patent Office Examining Corps, and for several years has been with a leading patent law firm in Washington.

MR. DAVID S. HAWKINS has opened an office in the Rose Building, Cleveland, Ohio, and will make a specialty in co-operating with attorneys where expert engineering is required in the preparation and the prosecution of legal cases. Mr. Hawkins is a graduate of the Massachusetts Institute of Technology and has had 15 years of experience as draftsman, designer, estimator and engineer with the General Electric Company, Pennsylvania Railroad, Pope Motor Carriage Works, F. H. Richards (patent attorney), Pratt & Whitney Company, Westinghouse Electric & Manufacturing Company and the J. D. Smith Foundry Supply Company.

MR. GEORGE B. TRIPP has resigned as business manager of the Central Colorado Power Company and has been elected to the management of the following Colorado Springs properties, viz.: The Colorado Springs Electric Company, the Pike's Peak Hydro-Electric Company, the Colorado Springs Light & Power Company (gas) and the Empire Water & Power Company. The last named corporation has been formed to construct reservoirs, pipe lines and a power plant at Manitou, Col. These companies are all controlled by the Susquehanna Railway, Light & Power Company, of 40 Wall Street, New York, of which Mr. George Bullock is president. The former manager, Mr. E. P. Dillon, has resigned, to take up engineering work with companies controlled by the same interests.

Trade Publications.

IGNITION BATTERIES are described in a folder issued by the Western Electric Company, Chicago, Ill.

REAMERS.—The Cleveland Twist Drill Company, Cleveland, Ohio, has issued an attractive folder calling attention to its high-speed reamers.

CONDENSING MACHINERY.—Catalog No. 74 of the Dean Bros. Steam Pump Works, Indianapolis, Ind., gives much interesting and valuable data relating to air pumps and condensers of the jet and surface types.

REFLECTORS.—The January issue of *Holophane Illumination*, published by the Holophane Company, 227 Fulton Street, New York, contains much instructive information relating to prismatic reflectors for all purposes.

SINGLE-PHASE MOTORS.—The advantageous features of self-starting single-phase motors are well presented in Bulletin 83 of the Wagner Electric Manufacturing Company, St. Louis, Mo. The motors described are of the constant-speed and variable-speed types.

SECOND-HAND ELECTRICAL MACHINERY.—The February *Bargain Sheet* of the Gregory Electric Company, Chicago, Ill., contains a complete price list of used generators, motors, transformers, switchboards, watt-hour meters, etc. Special reductions are offered in direct-current generators.

ELECTRIC PUMP GOVERNORS for automatically controlling the operation of motor-driven air-compressors between predetermined minimum and maximum air pressures are well described and illustrated in Instruction Pamphlet T 5042 of the Westinghouse Traction Brake Company, Pittsburg, Pa.

PORCELAIN INSULATORS for high tension are well illustrated and briefly described in insulation catalog No. 2 of the Ohio Brass Company, Mansfield, Ohio. These insulators are designed for all electromotive forces up to 60,000 volts. Price lists are given of the insulators and various transmission line specialties, such as cross-arms, pins, clamps, bolts, anchors, etc.

Business Notes.

MR. C. D. WOOD, JR., has resigned as treasurer of the Electric Home Supply Company, and established offices at 136 Liberty Street, New York, to transact business as a jobber of electrical supplies.

EXCEL ELECTRIC HEATING COMPANY, which was formerly located at 54 Vesey Street, New York, has moved to extensive quarters at 237 Broadway, corner Park Place. It invites inspection of its stock of electric heating appliances at the new show rooms.

THE AMERICAN BLOWER COMPANY.—Announcement is made of the consolidation of the American Blower Company, of Detroit, and the Sirrocco Engineering Company, of New York, under the name of American Blower Company, with principal offices at Detroit, Mich.

DOSSERT & COMPANY, New York, have received an order from the Wilson-Maeulen Company, New York City, for 200 solderless connectors to be installed on electric pyrometers; also an order from the American Electrical Supply Company, of Chicago, for 450 two-ways and front lugs for use in the plant of the Buick Motor Company, Flint, Mich.

STANDARD ROLLER BEARING.—Announcement is made by the Standard Roller Bearing Company, Philadelphia, of the further expansion of its sales organization by the appointment of F. M. Germane, formerly sales manager, as assistant general manager of the company; T. J. Heller, as sales manager, and F. W. Lawrence, as Western representative, the latter with headquarters at Chicago.

THE BELDEN MANUFACTURING COMPANY, Chicago, Ill., has been appointed special agent for the Hope Webbing Company, of Providence, R. I. The company will have complete charge of the sales of electrical tapes, webbings and sleevings for the Hope Webbing Company in Illinois, Wisconsin, Iowa, Minnesota, South Dakota, North Dakota and Montana, and will carry a large stock of these goods in its Chicago warehouse, from which immediate deliveries to the Western trade can be made.

THE LORD ELECTRIC COMPANY, 213 West Fortieth Street, New York City, has appointed the Monroe Brass & Wire Company, of Cincinnati, exclusive territorial agent in the Cincinnati territory. It will handle the various products of the Lord company, including Earll retrievers and catchers, laminated soldered rail bonds, Shaw lightning arresters, auto discharge, laminar and vertical unit choke coils, together with other specialties that are now being placed on the market. T. C. White & Company have been similarly appointed for the St. Louis territory, and W. R. Garton Company for the Chicago district.

THE NELSON VALVE COMPANY, of Chestnut Hill, Philadelphia, Pa., has surrendered its New Jersey charter and will be incorporated under the laws of Pennsylvania. The works of the company are located at Wyndmoor, Pa. The new charter of the company will empower the company to manufacture and sell pipe, valves, machinery, fittings and steam specialties. The company will be capitalized at $1,000,000. The company is now manufacturing a new valve calculated to stand the pressure of superheated steam, no matter what degree of heat the steam registers. The officers of the company are: Samuel F. Houston, president; Carlisle Mason, vice-president and general manager, and Russell Bonnell, secretary and treasurer.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 2, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

911,029. CONTROLLER; H. W. Cheney, Norwood, Ohio. App. filed Oct. 21, 1907. For electric motors. Avoids moving the controller too rapidly by locking it positively at each operative position until the current in the armature is below a predetermined value.

911,030. COMBINED CONTROLLER AND CIRCUIT-CLOSER; De Witt C. Cookingham, Cleveland, Ohio. App. filed Sept. 11, 1907. The machine may be left with safety without danger of tampering by an unauthorized person and the operator may throw open the circuit-closer instantly when desired. Makes use of a movable circuit-closing device carried by the handle with means for holding it against a closing movement when the controller is on.

911,032. ELECTRIC-TERMINAL CLIP; W. E. Dow, Braintree, Mass. App. filed Oct. 5, 1907. The jaws are rigid at their inner ends and approximately flat at their outer ends and angularly bent between the ends to provide stiff spring action for the outer ends.

911,036. INTEGRATING-WATTMETER; B. E. Getchell and Oscar O. Smith, Connellsville, Pa. App. filed Feb. 26, 1908. Commutator type of meter with sectionally wound field coils and a switch by means of which the meter can be set for any of its rated capacities. Used on direct and alternating current.

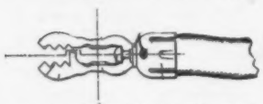
911,055. MOUNTING FOR FUSES; J. J. Lyng, New York, N. Y. App. filed May 23, 1907. A tube with a body of soft metal about the end of the tube, a terminal screw in the body and projecting therefrom, together with a fuse wire in the tube with its end in the soft metal.

911,081. COLLECTOR-RING AND CLAMPING-PLATE; C. H. Smoot and H. Hertz, Chicago, Ill. App. filed Jan. 2, 1906. For rotating field magnets of high speed a. c. generators, in which the iron core is built up of disks and carries conductors formed of bars. The end disks form the terminals of the field winding.

911,101. AUDIPHONE-TRANSMITTER; C. E. Williams, Natick, Mass. App. filed Aug. 6, 1907. A closed reverberatory chamber is provided at the front side of the audiphone for receiving and amplifying the sound waves and conveying them to the electric transmitter.

911,118. RAILWAY SIGNAL SYSTEM; R. B. Davis, Los Angeles, Cal. App. filed Nov. 8, 1907. Takes the place of the air signal system by providing a quick acting electrically operated valve for the whistle. The whistle is blown by compressed air from the main reservoir on the locomotive. The air is controlled by a valve and the valve by electric circuits operated by push-button switches in the train.

911,141. PROCESS OF AGGLUTINIZING ACTIVE MATERIAL FOR ELECTRIC ACCUMULATORS; O. Marino and E. W. Barton-Wright, London, Eng. App. filed Dec. 17, 1906. Mixes castor oil



911,032—Electric Terminal Clip.

911,055—Mounting for Fuses.

with a little powdered litharge and manganese peroxid, boils the mixture, decants the oil, dissolves the oil in a hydro-carbon solvent, mixes with litharge and adds acidulated water.

911,147. INDUCTION MOTOR AND GENERATOR; R. D. Mershon, New York, N. Y. App. filed April 29, 1905. The secondary element is provided with a winding and a plurality of condensers, resistances and impedances connected with the winding in order to reduce the effect of the stray field on the power factor at starting.

911,168. STORAGE-BATTERY PLATE; E. W. Smith, Philadelphia, Pa. App. filed April 13, 1908. The connection between the body and the sides and rim of the plate are improved by making the body of fine ribs, together with reinforcing ribs and a rim having a tapering web that extends inward.

911,178. TELEPHONE-RECEIVER; H. W. Sullivan, London, Eng. App. filed Nov. 30, 1907. A head supported telephone receiver with a multiple point spark gap in shunt with the magnets and within the casing in order to prevent injuring the windings of the magnet by high tension currents.

911,181. INTERCOMMUNICATING TELEPHONE; H. C. Thomson, Boston, Mass. App. filed March 30, 1907. A switch mechanism comprising a contact plate with a series of plungers sliding through the plate, a contact plate in front of all the plungers, a contact spring at the side of each plunger and a locking plate for each plunger.

911,188. TELEPHONE TRUNKING SYSTEM; C. S. Winston, Chicago, Ill. App. filed Jan. 3, 1905. For use between magneto and common battery offices. Provides means for positively throwing the drop in the magneto cord circuit when the common battery subscriber returns his receiver to the hook.

911,190. AUTOMATIC RAILROAD-SWITCH; Felix Wolf, New York, N. Y. App. filed Sept. 25, 1907. The switch is operated by means of two motors, the armatures of which are connected by a screw located between the rails which screw sets and locks the switch.

911,209. RAIL-BOND PROTECTOR; W. B. Cleveland, Cleveland, Ohio. App. filed Oct. 28, 1907. Relates to laminated rail bonds to be attached laterally to the rails and to avoid stripping them from the rails by the wheels of wagons. Provides a protecting armor of harder material, the bond being welded to the armor and to the rail.

911,222. TURBINE-BLADE-FIXING MACHINE; S. Ziani De Ferranti, Hampstead, London, England. App. filed Sept. 26, 1904. For electrically welding turbine blades on their drums. A movably mounted blade clamp which carries the electric current and the blade, presses the blade against the drum. The drum is rotated step by step to position it for the insertion of successive blades.

911,231. TELEPHONE-TESTING SYSTEM; H. C. Goldrick, Indianapolis, Ind. App. filed Nov. 14, 1904. The testing plug of the operator's connective circuit is provided with a tip contact which is insulated from the talking contacts thereof and is connected by a separate conductor with the apparatus by which the test is made known to the operator.

911,260. APPARATUS FOR COLLECTING ATMOSPHERIC ELECTRICITY; W. I. Pennock, Philadelphia, Pa. App. filed June 26, 1907. A balloon in a high altitude carries a bar of wood upon which collectors made of spheres of coiled wire are mounted, the latter terminating in sharp points.

911,267. CONNECTOR FOR ELECTRICAL WIRES, CABLES AND CONDUITS; R. W. Pittman, New York, N. Y. App. filed Oct. 11, 1907. For securing the ends together and for attaching them to junction boxes. A bushing which is attached to a box, has parallel walls adjacent to the box and is clamped thereto by a pair of removable clamps.

911,293. JUNCTION-BOX; W. A. Charters and E. G. Bardwell, Buffalo, N. Y. App. filed Sept. 21, 1906. The junction-box is provided with an opening and a resilient bridge lies across the opening. A supporting member extends through the bridge and has a head gripped between the bridge and the box.

911,303. ELEVATOR-INDICATOR; J. D. Griffen, New York, N. Y. App. filed March 22, 1897. A floor indicator comprising several groups of electric lamps, one group in each story of the building with an electric switch for each group and a cam on the elevator car for operating the switch.

911,338. CONNECTING-JACK FOR TELEPHONE-SWITCHBOARDS; C. H. Smith, Chicago, Ill. App. filed Dec. 30, 1904. A jack frame formed of one piece of integral metal with offset side braces, whereby the upper and lower jack contacts may be readily observed from the opposite sides of the jack. The forward part of the jack is made double to accommodate threads.

911,339. PARTY-LINE INDICATING-KEY; C. H. Smith, Chicago, Ill. App. filed Aug. 5, 1907. A key with a means for indicating to the telephone operator the last button of the key depressed and released in order to tell the operator which of the parties was last signaled.

911,364. DYNAMO-ELECTRIC MACHINE; H. A. Balcome, Boston, Mass. App. filed July 1, 1907. The field core is made of laminæ cut to form polar extremities which are clamped together between the side members of the motor frame.

911,384. KEYBOARD TELEGRAPHIC TRANSMITTER; P. B. Delany, South Orange, N. J. App. filed May 26, 1905. Provides a friction drive for causing the contact maker to travel over its contacts when the key is depressed. The drive consists of wheels whose axes are out of line and between which the traveling bar carrying the contact maker is disposed.

911,409. ARC-LAMP HEADLIGHT; B. B. Lacy, Houston, Tex. App. filed Sept. 24, 1907. Provides a steady light, notwithstanding jolting and a means for feeding the carbon by the use of a solenoid which operates the clutch lever and whose action is opposed by the pull of a spring and a dash-pot.

911,411. CARBON-HOLDER FOR ELECTRIC LAMPS; C. J. King, Olean, N. Y. App. filed April 30, 1908. The holder consists of two sections with an insulating joint between them. The section carrying the carbon is made of two jaws hinged together with a square opening. Details.

911,414. MULTIPLE-CYLINDER-MOTOR IGNITION APPARATUS; B. L. Lawton, Meriden, Conn. App. filed June 19, 1907. Avoids cross-firing in multiple cylinder cars by placing a soft iron plate between the coils, thus eliminating cross induction.

911,429. CLEAT FOR ELECTRIC WIRING; R. McLennan, Ballston Spa, N. Y. App. filed Feb. 18, 1908. A cleat for use at a bend in the wires consisting of two right-angled portions, the engaging faces of said base and cap having oppositely disposed grooves for the reception of the wire.

911,438. TELEPHONE-RECEIVER; W. E. Peters, Athens, Ohio. App. filed Dec. 24, 1907. A head telephone provided with a cap whereby pressure upon the ear will be transferred to the head so as to avoid bruising the ear.

911,439. CONTACT-PLUG FOR ELECTRIC IRONS, HEATING APPLIANCES, AND THE LIKE; R. H. Pheysey, Ontario, Col. App. filed Aug. 22, 1907. For connecting a circuit to the iron to be heated. An insulating plug carries the contact members.

911,446. THERMO-ELECTRIC PILE; Adolf Rittershaussen, Cassel, Germany. App. filed June 9, 1908. Two concentric metal rings form the metallic element of the thermo-pile. These are superimposed in groups and the product of the periphery and the height of each contact surface in the proximate rings is substantially uniform throughout the pile.

911,448. TROLLEY; P. H. Rosskamp and Ludwig Kellermann, Tarentum, Pa. App. filed Aug. 24, 1908. The trolley wheel is prevented from leaving the trolley by means of two arms which extend above the wheel and are on opposite sides of the trolley wire. Details.

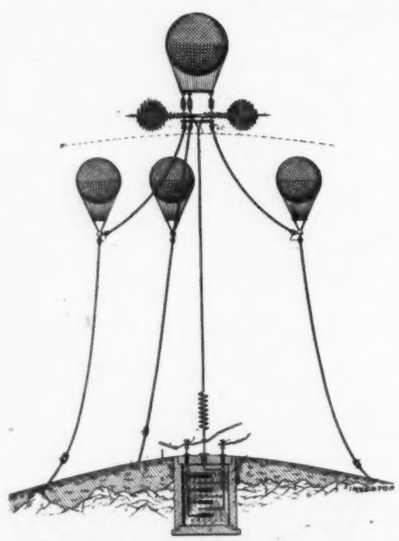
911,475. MULTIPLE LAMP-SOCKET; L. J. Castonguay, Bridgeport, Conn. App. filed Aug. 5, 1908. Reduces the manufacturing cost by utilizing strips of brass bent into ring form. The cluster has a series of units, each unit with its axis inclined, but with its insulating base piece parallel to the axis of the cluster and strip metal pieces mechanically connecting the units.

911,481. INDUCTION-MOTOR CONSTRUCTION; H. F. Elshoff, Norwood, Ohio. App. filed Feb. 7, 1906. Hollow rivets or bolts are used to connect the conductor bars and the short-circuiting rings, which hollow rivets permit a circulation of cooling air through the ends of the bars and the rings.

911,522. ELECTRIC-BATTERY HOLDER AND BATTERY; G. L. Patterson, New York, N. Y. App. filed April 18, 1908. A battery holder with electrical and mechanical connections for a plurality of batteries, avoiding the binding posts ordinarily used. May be quickly applied to a side wall.

911,527. IGNITION-TIMER; L. B. Shivers, Anglesea, N. J. App. filed June 17, 1908. A timer to be used in jump spark ignition in which the wear of the parts is reduced. A free rotatable conducting ring is interposed between the rotatable element and the exterior concentric fixed element.

911,531. TELEPHONE APPARATUS; C. H. Viggars and E. H. Stolz, Chicago, Ill. App. filed Jan. 13, 1908. For assisting the deaf to hear. One of the electrodes is provided with upwardly extending cylindrical



911,260—Apparatus for Collecting Atmospheric Electricity.

sockets in each of which there is a single row of carbon granules in an electric circuit.

911,549. ELECTRIC RELAY; Fitzhugh Townsend, New York, N. Y. App. filed June 13, 1904. A relay operated by alternating current in an automatic block-signaling system for electric railways, comprising a fixed member with polar extensions and a pivoted coil mounted there between, whose plane when in equilibrium is that of the magnetic field between the polar extensions.

12,914. (Reissue.) MECHANISM FOR GONGS AND THE LIKE; H. E. Reeve, New York, N. Y. App. filed Oct. 15, 1907. A gong, a hammer and a shaft carrying the hammer, the axis of the shaft being inclined and the cam supporting the hammer, the face of which has a gradual inclination throughout its periphery.